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Post-diagnosis quality of life and mortality in non-Hispanic White and Hispanic women diagnosed with invasive breast cancer.

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POST-DIAGNOSIS QUALITY OF LIFE AND MORTALITY IN NON-HISPANIC WHITE AND HISPANIC WOMEN DIAGNOSED WITH INVASIVE BREAST CANCER

By

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B.S., University of Louisville, 2016

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ABSTRACT

POST-DIAGNOSIS QUALITY OF LIFE AND MORTALITY IN NON-HISPANIC WHITE AND HISPANIC WOMEN DIAGNOSED WITH INVASIVE BREAST CANCER

Delvon T. Mattingly

August 7, 2018

The prevalence of breast cancer is increasing, and the health-related quality of life (HRQOL) of breast cancer survivors may help to further understand survivorship. This study evaluated HRQOL as a potential prognostic factor for mortality among Non-Hispanic White (NHW) and Hispanic women diagnosed with invasive breast cancer. Data were used from the Health, Eating, Activity, and Lifestyle (HEAL) Study. Data for 351 participants were analyzed for associations between HRQOL scores (subscale, component) and mortality. Cox proportional hazards regression was conducted to assess the relationship between HRQOL and mortality outcomes (all-cause, breast cancer-specific, non-cancer). Median follow-up time from HRQOL assessment (approximately 36-months post-diagnosis) to the end of the study period was 11.2 years. There was a statistically significant association between the physical component summary score and all mortality outcome measures for all women and when stratified by race/ethnicity. HRQOL evaluated post-diagnosis was a significant predictor of long-term mortality in this population.

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INTRODUCTION

Summary

Breast cancer remains a leading cause of cancer-related diagnoses and deaths in women (1). The estimated number of breast cancer survivors is rising due to increasing rates of long-term survival, and improving survivorship (1, 2). Minority women, most notably African American and Hispanic women, in the United States tend to have poorer breast cancer prognosis and survival outcomes compared to their Non-Hispanic White (NHW) counterparts (3-7). However, recent studies have suggested that this is inconclusive when comparing NHW and Hispanic women (8-10). Measures of health-related quality of life (HRQOL) encompass the overall well-being of individuals while assessing areas of interest that may be affected by illness or post-diagnosis treatments (11). While breast cancer survivors are living longer, they may require mental and physical adjustment in response to their diagnosis and treatment (12). Studies assessing HRQOL as a predictor of breast cancer prognosis, including studies evaluating the impact of HRQOL in long-term breast cancer survivor populations are limited (13, 14), as well as similar studies of underrepresented populations, such as Hispanic women (15, 16).

Objective

Utilizing data from the New Mexico site of the Health Eating Activity and Lifestyle (HEAL) study, the objective of this study is to evaluate Health-Related Quality of Life (HRQOL) at 36-months post-diagnosis and determine its association with mortality among Hispanic and NHW women diagnosed with invasive breast cancer.

Specific Aims

1. To compute HRQOL subscale and MCS and PCS scores by all-cause, breast cancer-specific, and non-cancer mortality.
2. To determine if survival probabilities differ by HRQOL MCS and PCS scores measured at 36-months post-diagnosis among all women and by ethnic groups.
3. To evaluate the association of HRQOL subscale and MCS and PCS scores at 36-months post-diagnosis with all-cause, breast cancer-specific, and non-cancer mortality among all women and by ethnic groups, adjusting for relevant confounders.

Hypotheses

1. There will be differences in HRQOL subscale and MCS and PCS scores between women who are alive and women who died from all-cause, breast cancer-specific, and non-cancer mortality.
2. Survival probabilities in women with poorer HRQOL will significantly differ from women with better HRQOL overall and by ethnic group.

3. Women with poorer HRQOL MCS and PCS scores will be at higher risks of dying by all-cause, breast cancer-specific, and non-cancer mortality, compared to their counterparts with better HRQOL. These associations will reflect similarly among a few HRQOL subscales but not all of them.

LITERATURE REVIEW

Breast Cancer Survivorship in the U.S.

Breast cancer remains a leading cause of cancer-related diagnoses and deaths in women with an estimated incidence of 266,120 new diagnoses and 40,920 estimated deaths in 2018 (1). In breast cancer patients receiving treatment, long-term survival is common, with a 5-year survival rate of nearly 90% (1, 2), 83% for 10-year survival (2), and 78% for 15-year survival (2). Survivorship is defined simply as "Living with, through, and beyond cancer," (17). Since long-term survival rates are increasing, breast cancer survivors face a multitude of convoluted barriers when dealing with the implications of their diagnoses and treatments, including pre-existing or developed comorbid conditions, during survivorship (18).

As of January, 2016, the estimated number of breast cancer survivors in the United States is 3,560,570, and this is theorized to increase to 4,571,210 by January, 2026 (2). Post-treatment, breast cancer survivors contend with life-changing responsibilities such as seeking follow-up medical care, developing a wellness plan—which includes ways to take care of physical, emotional, social, and spiritual needs—and staying in contact with a physician or cancer specialist (19). The American Cancer Society recommends a number of guidelines for survivorship care, including the evaluation and management of physical and mental/psychosocial effects of diagnosis and treatment (20).

HRQOL and Breast Cancer Survivorship

The burden of breast cancer at diagnosis and throughout survivorship may require mental/psychosocial and physical adjustment, which has often been described as self-reported health-related quality of life (HRQOL) (12). While survivorship increases in breast cancer survivors, so will a variety of health problems, derived from breast cancer or its treatment over short- or long-term survivorship, which may require care. These health problems can exacerbate the well-being of survivors, and studies have suggested that HRQOL is a good indicator of detriments related to breast cancer survivorship (21, 22). Considering the increasing survival rates for women diagnosed with breast cancer, limited research has evaluated the effects of HRQOL measured post-diagnosis on long-term survival or mortality (14, 16, 22-24). By 2026, the population of breast cancer survivors is expected to increase by approximately 30% (25). Since HRQOL may have a direct impact on breast cancer outcomes, understanding the relationship between them is important to bolster survivorship research and improve specified developments of interventions and clinical care tactics, including guidelines recommended by the ACS (20).

Breast Cancer Survival and Mortality in Hispanic Women

The latest SEER cancer registry data estimates that in 2015 incidence of breast cancer in NHW women was 133.8 per 100,000 individuals, compared to 90.3 per 100,000 in Hispanic women (1), a 38.8% difference between the two populations.

Although breast cancer incidence is higher in NHW women, Hispanic women tend to have poorer breast cancer prognosis, higher odds of being diagnosed with estrogen-receptor/progesterone-receptor negative (ER-/PR-) breast cancer subtypes, a greater number of positive lymph nodes, higher odds of being diagnosed with more advanced breast cancer, and poorer survival outcomes. These outcomes include a higher risk of breast-cancer specific mortality and a poorer HRQOL compared to NHW cases (3-7). However, recent studies suggest this is inconclusive (8-10). Recent Centers for Disease Control and Prevention (CDC) projections indicated that Hispanic women have a lower rate of breast cancer-related death per 100,000 women (13.6) compared to NHW women (19.8) (9). A 2017 report concluded that 5-year survival by tumor stage is relatively similar between Hispanic and NHW women. When Hispanic women were diagnosed with a distant or unknown tumor stage, their survival was higher than NHW women (10).

Many established risk factors that impact breast cancer prognosis have been compared between NHW and Hispanic women (26-28). Despite growing evidence that breast cancer survival is improving in minorities, due to better cancer screening and treatment strategies, disparities in clinical characteristics and mortality persist and remain unexplained (29). A better understanding of prognosis following a breast cancer diagnosis in diverse populations is important, given that between 2016 and 2017, the Hispanic population accounted for over half of the U.S. population growth (30), and it is projected to almost double from 56 million to 119 million by 2060 (31). A research gap exists evaluating the relationship between HRQOL and breast cancer prognosis in minority populations, including Hispanic women (32).

Overall HRQOL

HRQOL is an evolving concept that may have either positive or negative associations with cancer survival depending on the way it is defined. HRQOL is commonly defined in terms of physical and mental responses to illness, as measured from self-reported information on functional, psychological, social, spiritual, and sexual well-being (33, 34). There are several validated instruments used to measure HRQOL in cancer patients. These include the 36-item Short Form Health Survey (SF-36) (35, 36); the Functional Assessment of Cancer Therapy, both the General (FACT-G) version and the Breast Cancer-specific (FACT-B) version (37, 38); and the European Organization for Research and Treatment of Cancer Quality of Life Questionnaire (EORTC QLQ-C30) (39, 40). Some studies use a combination of psychosocial scales to evaluate HRQOL among women diagnosed with breast cancer (41-43).

The SF-36 instrument, which is used to evaluate physical and mental HRQOL across various chronic diseases and validated among diverse population groups (35), was chosen as the primary instrument used for this thesis study. Eight subscales can be derived from the 36 questions to measure physical and mental domains of HRQOL. Physical functioning, role limitations-physical (role physical), bodily pain, and general health subscales are used to calculate a physical health component summary score; and social functioning, role limitations-emotional (role emotional), vitality, and mental health subscales are used to calculate a mental health component summary score (44, 45). Measures of HRQOL summarize the overall well-being of individuals while assessing specific areas of interest that may be affected by an individual's condition of disease as well as by treatment (11).

Previous studies suggest that Hispanic women diagnosed with breast cancer frequently report lower overall HRQOL compared to NHW cases (32). Additionally, they report a lower socioeconomic status, and are usually diagnosed at a younger age and a later tumor stage (32) Some studies suggest that a disparity exists between NHW and Hispanic women for HRQOL, which may be related to differences in socioeconomic status, treatment, and cultural factors (32, 46).

Mental/Psychosocial HRQOL

Breast cancer survivors experience mental/psychosocial adjustment post-diagnoses and pre- and post-treatment (47-49). Mental HRQOL in breast cancer survivors is primarily associated with age (28), stress (50), anxiety (41), depression (41, 51-53), social support (54, 55), coping (56), feelings of helplessness/hopelessness (57), and religiosity/spirituality (58); however, much of the extant research evaluate ethnically homogenous populations, or populations containing one predominant race/ethnicity. Among these factors, declines in mental/psychosocial HRQOL were associated with younger age at diagnosis (28), higher stress (50), higher anxiety (41), higher depression or more depressive symptoms (41, 51-53), social isolation (including low levels of social support) (54, 55), negative forms of coping (56), feeling helpless/hopeless (57), and lower levels of religiosity/spirituality (58). Some studies have suggested that components of mental HRQOL have been shown to improve over time in breast cancer patients shortly after diagnosis (59) and after short-term treatment (60), while other aspects have suggested some exacerbate HRQOL (61). Mental HRQOL is theorized to be lower in Hispanic women compared to NHW women for all cancers (61). Hispanics may also

report poorer psychological and emotional well-being compared to other ethnic groups (15, 62).

Physical HRQOL

A breast cancer diagnosis and the effects of breast cancer treatment influence physical HRQOL (59). Factors associated with physical HRQOL in breast cancer survivors include, but may not be limited to, age (28, 63), physical activity (64, 65), treatment type (60, 66) including mastectomy (52), psychological well-being (63), social support (54, 55), body mass index (BMI) (16, 67, 68), fatigue (53, 64, 69, 70), and pain (69, 71). Long-term breast cancer survivors usually report good HRQOL, yet these women may still experience some physical-related complications (72). Among these factors, declines in physical HRQOL were associated with younger age at diagnosis (28), yet conversely other studies revealed that younger age was predictive of higher HRQOL (63), lower physical activity (64, 65), not receiving treatment (60, 66), receiving a mastectomy (52), lower psychological well-being (63), lack of social support (54), obesity (16, 67, 68), present fatigue (53, 64, 69, 70), and present pain (69, 71)

In minorities specifically, physical HRQOL is higher when patients are diagnosed with a lower stage of disease, fewer comorbidities, exercise more, and have healthier diets. (51). Compared to other ethnic groups, Hispanic breast cancer survivors report more physical symptoms during survivorship (73), and declines in physical and functional well-being are significantly associated with survival (50). Additional factors, such as sexual functioning, responses to treatments and therapies, pain, and fatigue, impact HRQOL post-breast cancer diagnosis (46, 49). In a multi-ethnic sample of breast

cancer survivors including Europeans, Africans, Latinas, and Asians, socio-ecological factors and health care varied by race/ethnicity, while psychological well-being showed consistency, suggesting a relationship driven by physical components of HRQOL one to five years post-diagnosis (63). In long-term breast cancer survivors, treatment type is predictive of HRQOL, specifically chemotherapy worsening physical-related HRQOL (74).

Clarifying how differences in HRQOL influence mortality is necessary in understanding survival disparities in cancer patients. Studies assessing HRQOL as a predictor of short- and long-term breast cancer survival are limited, especially studies including underrepresented populations, such as Hispanic women (15, 16).

HRQOL and Breast Cancer Prognosis

Previous epidemiologic studies have assessed indicators of poorer HRQOL in breast cancer survivors (23, 28, 41, 52, 58, 75-77) while other studies have evaluated levels of HRQOL in breast cancer survivors to understand health-related experiences of survivorship (24, 32, 46, 55, 59). Of the studies that have assessed HRQOL as a predictor of breast cancer prognosis (13, 14, 42, 43, 50, 78-82), few have focused on underrepresented populations (62, 83). A meta-analysis evaluating HRQOL as a prognostic predicator of cancer survival in patients, using studies assessing HRQOL via the EORTC QLQ-C30, found that HRQOL may be useful in distinguishing survival patterns (81). Research examines the HRQOL status of breast cancer survivors, with fewer studies utilizing HRQOL as a predictor of breast cancer prognosis, as well as longitudinal designs that can evaluate survival over a long-term (13, 14). Among these

longitudinal studies, a report suggested that changes in components of HRQOL may have an impact on survival (14).

Though, the relationship between HRQOL and breast cancer prognosis isn't fully understood, studies evaluating components of HRQOL show that factors are positively and negatively associated with the risk of breast cancer prognosis (84).

HRQOL Factors

Perceived social support, social networks, and marriage are positive indicators of a lower risk of breast cancer mortality (85, 86). A study examining the association between post-diagnosis HRQOL in breast cancer patients and breast cancer mortality and recurrence found that social well-being at baseline is a significant indicator of mortality (HR: 0.62, 95% CI: 0.46, 0.85) and recurrence (HR: 0.52, 95% CI: 0.38, 0.71) (83).

In a study by Goodwin et al., better role functioning and better avoidance significantly ($p<0.05$) predicted a lower risk of overall survival (HR=0.56 and 0.48, respectively), while domestic environment was significantly associated with a 1.5-fold increased risk of death (42). Other studies have indicated that high scores for anxious preoccupation are associated with poorer distant disease-free survival and overall survival (78). Helplessness or hopelessness also has been reported as an indicator of poorer disease-free survival (HR: 1.53; 95% CI: 1.11, 2.11), with a significant effect maintained over ten years of follow-up (14). Findings from two studies suggested that better emotional functioning is associated with improved survival (HR: 0.81; 95% CI: 0.70, 0.95) (13) and (HR: 0.49; 95% CI: 0.22, 1.09) (50). However, both studies used different HRQOL measurements and assessed HRQOL at different time points (13, 50). In a

systematic review of studies evaluating the impact of psychosocial factors on breast cancer prognosis, at least 80% found a significant protective or exacerbating association between one or more psychosocial factors and survival or recurrence (62).

Several studies have shown a significant association between mental HRQOL components and breast cancer prognosis (13, 14, 42, 43, 50, 80, 83). Some reported that higher mental-related functioning predicted lower risk of dying from breast cancer in (83, 87), with hazard ratios ranging from 0.56 to 0.66 (83, 87). However, one study reported that breast cancer survivors with higher cognitive functioning had decreased survival (HR: 1.76, p-value: 0.041) (42). Three studies showed significant associations between physical HRQOL components and breast cancer mortality (87-89). Women who reported higher levels of physical-related health or functioning had decreased risks of mortality, with hazard ratios ranging from 0.42-0.64 (87, 89), while women who reported lower levels of physical-related functioning had increased risks of all-cause mortality (HR: 1.49, 95% CI: 1.17, 1.89) and breast cancer-specific mortality (HR: 1.39, 95% CI: 1.07, 1.80) (88).

Studies evaluating physical HRQOL as a predictor of breast cancer outcomes (13, 50, 79-82, 87-92) have suggested that better levels of physical and functional HRQOL were associated with decreased risk of all-cause mortality (HR: 0.24; 95% CI: 0.08, 0.70 and HR: 0.35; 95% CI: 0.14, 0.87, respectively) (50). Physical functioning is also proven to be of significant prognostic value in survivors of multiple cancers (81). Components of physical HRQOL, such as mood, pain, and loss of appetite, were also found to be significant predictors of mortality in breast cancer patients (81, 82, 93). Nausea/vomiting has been reportedly associated with increased risk of breast cancer recurrence (79). One

study concluded that fatigue increased risk of recurrence-free mortality (13), and another suggested that severe fatigue led to shorter survival (HR: 1.48; 95% CI: 1.13, 1.93) (91).

Three studies that utilized the SF-36 indicated that better physical health or physical functioning were predictive of lower risks of mortality (87-89). Saquib et al. found that higher levels of physical health predicted lower additional breast cancer events (p-trend: 0.005) and lower risk of all-cause mortality (p-trend: 0.004) (89). Marinac et al. reported that participants with low physical functioning were more likely to die by all-causes (HR: 1.49, 95% CI: 1.17, 1.89) and breast cancer-specific causes (HR: 1.39, 95% CI: 1.07, 1.80). DuMontier et al. found that better levels of physical functioning were predictive of lower mortality (OR: 0.64, 95% CI: 0.44, 0.94).

Taken together, the studies have evaluated HRQOL as an indicator of breast cancer prognosis (13, 14, 42, 43, 50, 78-81, 83, 87-95) are heterogeneous. Most studies are limited by their sample sizes ($n < 1,000$) (14, 42, 43, 78, 79, 87, 90-94), and they differed in the use of the specific HRQOL instrument. Out of the 19 studies evaluated, one used the Linear Analog Self-Assessment (LASA) (80), seven used the EORTC QLQ-C30 (13, 42, 43, 91, 93-95), one used both the Functional Assessment of Cancer Therapy General (FACT-G) and/or the Functional Assessment of Cancer Therapy (FACT-B+4) (50), one used the IBCSG Quality of Life Core Questionnaire (79), one used the General Quality of Life Inventory-74 (83), three used the Medical Outcomes Study (MOS) Short-Form Survey (SF-36) (87-89) and the remaining studies utilized a combination of physical or psychosocial scales to measure HRQOL (13, 14, 42, 43, 78). The majority of studies have been based predominantly on white populations (62, 83). Furthermore, the majority of the studies evaluated breast cancer survival as an outcome (13, 14, 42, 43, 50,

78, 80, 81, 83, 89-95), while four evaluated mortality (83, 87-89) and recurrence (79, 83, 88, 89)

The variance in breast cancer and all-cause mortality that HRQOL might explain could help improve efforts that focus on addressing HRQOL in breast cancer survivors as they deal with survivorship. Further research is necessary to analyze these associations in underrepresented populations to add to extant findings and increase the plausibility of generalizability.

Potential Covariates

Recognized breast cancer prognostic factors include cancer metastasis, size of tumor, tumor grade, hormone receptor status, lymph node involvement, age at diagnosis, breast cancer recurrence (location of recurrence, time to recurrence), adjuvant therapy, comorbid conditions, family history of breast cancer, age, socioeconomic status (96-98). Many of these factors are associated with HRQOL including adjuvant therapy, cancer metastasis, tumor characteristics, lymph node involvement, comorbid conditions, age at diagnosis, and breast cancer recurrence (28, 60, 66, 72, 83, 99-101). Additional factors that may impact the relationship between HRQOL and risk of mortality include race/ethnicity, menopausal status, clinical characteristics, psychosocial factors, lifestyle and physical factors.

Race/Ethnicity

Breast cancer mortality and treatment differs by race/ethnicity (6, 29). Minority women are diagnosed with more advanced stage breast cancer (102) and usually report

worse HRQOL (51, 61, 103). A study has found that race/ethnicity modifies the association between tumor subtype and mortality (104).

Menopausal Status

Menopausal status can modify breast cancer risk and survival, and is usually associated with other factors. For example, post-menopausal breast cancer survivors who are not overweight or obese tend to have better survival rates (105, 106). The opposite trend appears to be true for premenopausal women who have better survival rates if they are overweight or obese compared to their normal-weight counterparts (106). A study found an association between high-cognitive fatigue and sever menopause, depressive symptoms, and worsened HRQOL (107).

Clinical Characteristics

Tumor size and lymph node status interact to modify the effect of survival (97). Tumor subtype predicts whether or not breast cancer patients require surgery and any other type of treatment, and tumor size influences the probability of metastasis occurring in breast cancer patients (97). Studies have shown that tumor characteristics impact HRQOL in breast cancer patients (68, 99). An increased number of axillary lymph nodes is predictive of breast cancer survival, metastasis, treatment failure, and recurrence (97). Women have reported higher HRQOL after surgical removal of affected lymph nodes (100). Types of adjuvant treatment prescribed are associated with breast cancer node type/tumor subtype. Although breast cancer patients have benefited from adjuvant therapy, regardless of tumor subtype (108), node-negative breast cancer patients do not

benefit significantly compared to node-positive breast cancer patients (97). HRQOL has been shown to worsen or improve in patients depending on the type of treatment they received (60, 100).

Mental/Psychosocial Characteristics

Depression is the most common of all psychiatric disorders (109), and a few studies have evaluated the effects of depression on HRQOL in breast cancer patients (41, 51, 52), and in long-term breast cancer survivors (110). Lower HRQOL scores are associated with depressive symptoms in breast cancer survivors (41, 53). Evidence suggests that psychosocial stress plays an important role in the development of cancer growth and metastasis (62, 111) and impacts HRQOL (50). Additionally, stress events, anxiety, hopelessness, repressive defensiveness, and denial/avoidance are associated with decreased breast cancer survival, whereas factors such as perceived social support, minimizing adjustment, extroversion, religiosity/spirituality, and marriage are associated with increased survival (62). Generally, many mental/psychosocial factors are associated with HRQOL in breast cancer survivors (41, 50, 54, 57, 58).

Lifestyle and Physical Factors:

An increase in physical activity has been shown to decrease breast cancer mortality overall (112) and in Hispanic women, specifically (113). Higher physical activity is predictive of better HRQOL in women diagnosed with breast cancer (64, 65). BMI and waist-hip ratio are associated with breast cancer survival and may differ by race/ethnicity (114, 115). Furthermore, other HRQOL and breast cancer survival studies

have indicated that obesity is associated with a decreased mental health among survivors (16). A study has found that higher BMI and waist-hip ratio were predictive of higher mortality in breast cancer survivors (116).

Lymphedema is a complication of lymph node dissection apart of breast cancer treatment (117). It is defined as the swelling of 100-200 cm^3 or 2 cm by circumference of an affected area in comparison to an unaffected area (117, 118). The prevalence of lymphedema in breast cancer survivors rises every year (119). Breast cancer patients who experienced lymphedema had poorer HRQOL (118, 120).

The association between diet and breast cancer prognosis is inconclusive (121). Studies have shown that better diet predicts lower all-cause mortality in breast cancer survivors (122, 123), while fewer studies have found a similar association between diet and breast cancer-specific mortality (122). Diet quality is associated with mental and physical HRQOL in breast cancer survivors (124). Women who have better diets tend to have higher HRQOL scores (124).

A systematic review found that current smoking increased the risk of all-cause death in breast cancer survivors (125). In a study evaluating breast, colorectal, and endometrial female cancer survivors, persistent smoking predicted increased likelihoods of poorer mental/psychosocial and physical HRQOL (126). In breast cancer survivors, HRQOL is poorer in women who smoke versus women who don't (127).

Possible Biological Mechanisms

HRQOL measures the overall well-being of breast cancer survivors. Lower scores or decreases in scores may reflect both acute and chronic stress responses to

cancer diagnosis, treatment, co-morbidity and various negative life changes (e.g. divorce or separation) (128). Evidence indicates that chronic stress is a nervous system response with signaling pathways that may directly impact cancer cells and promote cancer metastasis (111).

The human body responds to stress by activating body systems such as the hypothalamic-pituitary-adrenal (HPA) axis. Levels of norepinephrine and epinephrine are known to increase in people who experience acute or chronic stress (129), while dopamine levels may increase during episodes of acute stress but decrease in people who experience chronic stress (130, 131). Norepinephrine and epinephrine are known to induce a 'fight or flight' response from the sympathetic nervous system (SNS). These catecholamines also target β-adrenergic receptors that mediate their effects on cancer cells, including breast cancer cells (132).

Cortisol, a human glucocorticoid, regulates many cardiovascular, metabolic, immunologic, and homeostatic functions (133), and is secreted by the adrenal cortex in response to stress (134). Studies have shown that cortisol can disrupt neuroendocrine circadian rhythms to support tumor growth and metastasis (135). Chronic stress is involved in inhibiting immune responses, and increased levels of cortisol have been shown to be immunosuppressive (136). On the other hand, studies have shown that acute stress can amplify cellular immunity, increasing resistance to some cancer such as squamous cell carcinoma (137).

Stress also influences cancer metastasis (138). Norepinephrine has shown to stimulate VEGF, an angiogenic molecule that induces neovascularization of malignancy (138). Studies have linked positive and negative psychosocial factors to either an increase

or decrease of the regulation of VEGF in various cancer patients (139, 140). Additionally, the production of IL-6, another angiogenic molecule or cytokine, has been reported to increase or decrease based on the impact of psychosocial factors (141). Although there is limited evidence of the effects of stress on the proliferation of metastatic cancer cells, studies have suggested that the presence of catecholamines may suppress the production of normal or good cells, impacting an immune response to cancer cell proliferation. (142).

Other cytokines, such as IL-1 and TNF-α, may work synergistically with IL-6 to stimulate an inflammatory response in response to various stressors (109). The brain can also induce stress-inflammatory responses to perceived social-environmental hazards (109). Inflammation is partly regulated by cortisol, and when stress is high, inflammation can become chronic and promote diseases, such as cardiovascular, autoimmune disorders, and cancers (143). A study concluded that the association between HRQOL and mortality in breast cancer survivors may be contributed to inflammation as the core biological mechanism, where low levels of physical functioning predicts higher risk of mortality (88).

Chronic stress is associated with the pathogenesis of cancer and the development of tumor growth and metastasis (111). Cancers with improving survivorship, such as breast cancer, impact the overall well-being of survivors over short- and long-term periods following a diagnosis. The chronic relationship between stress-responses to what precedes and follows cancer, and the diagnoses of cancer itself, needs to be further evaluated in patients who are living longer with chronic diseases. Even though the association between HRQOL and mortality in breast cancer survivors, and the impact

stress may have on this association, is not completely understood, studies have found relationships between stress and HRQOL factors. One study found that socially isolated mice were more likely to develop stress via increased corticosterone levels (144), while another showed that exposure to inevitable foot-shock stress in rats reduced the innate activity of natural killer cells (145). Researchers have emphasized the importance of social support on breast cancer survivors, including its impact on reducing stress in these women (146, 147). Women who feel that they don't handle stress well tend to have lower HRQOL (50).

METHODS

Study Design

The Health Eating, Activity, and Lifestyle (HEAL) Study is a multicenter prospective cohort of 1,183 enrolled multi-ethnic women diagnosed with first primary *in-situ* or invasive (stages I to III-A) breast cancer between 1994 and 1999 (148). Participants were ascertained from the Surveillance, Epidemiology, and End Results (SEER) cancer registries in New Mexico, Los Angeles County (LA), and Western Washington. Women were initially followed to evaluate how lifestyle factors (physical activity, diet, weight history), hormones, and clinical characteristics had an impact on breast cancer outcomes and prognosis. Participants were evaluated over multiple time periods and each period differed by study site. For New Mexico, participants were evaluated at baseline, 2-year follow-up, 3-year follow-up, 5-year follow-up, and 10-year follow-up (149). Informed consent was obtained during each assessment. Institutional Review Board approvals were obtained at each participating center. Additional study design, recruitment processes, and aims have been previously described in detail (148). This study utilizes data from the New Mexico site only (N=616).

Eligibility and Recruitment

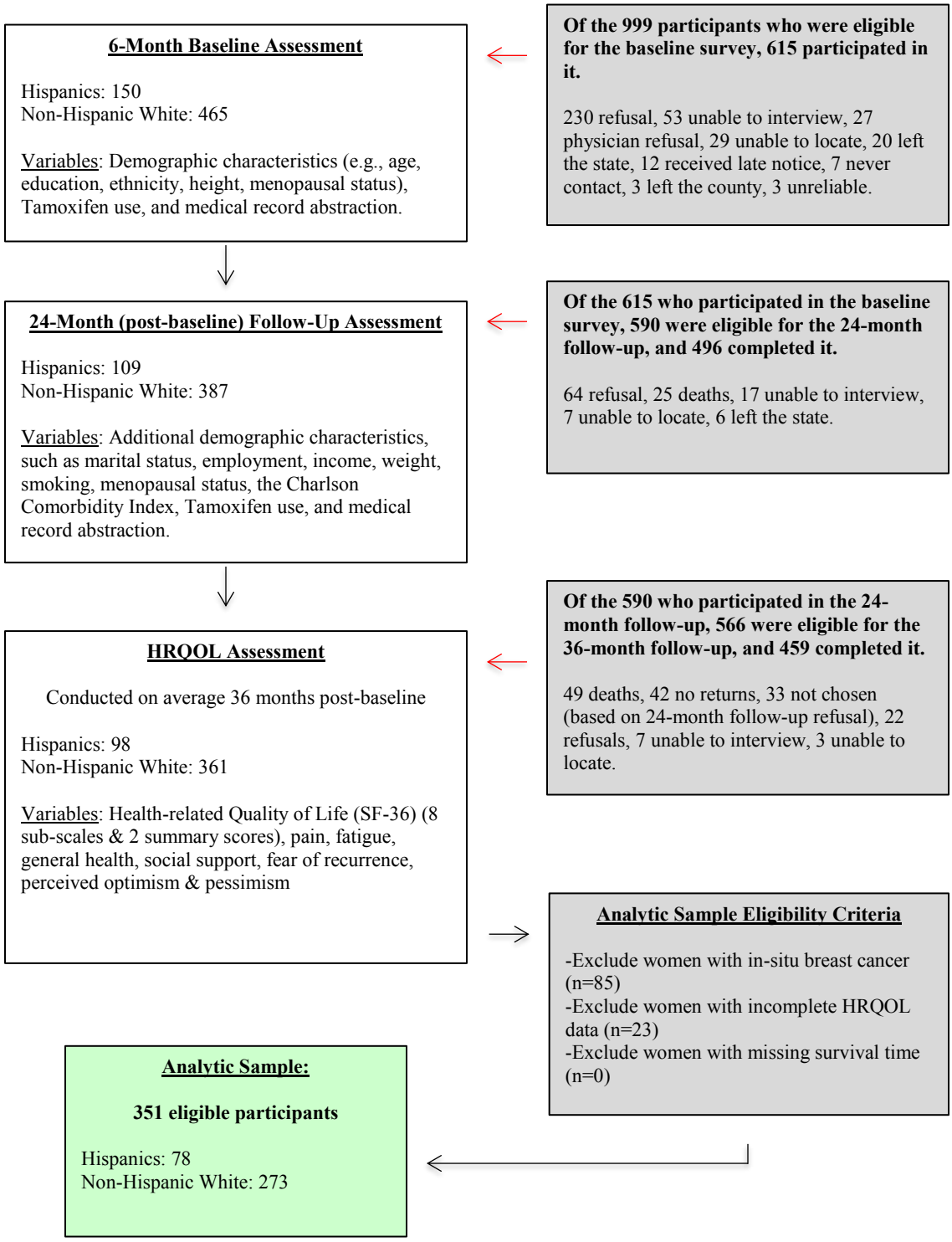
In the HEAL-New Mexico (HEAL-NM) site, women were eligible to be ascertained from SEER New Mexico Tumor Registry (NMTW) for the study if they were diagnosed with *in situ* to Stage IIIA breast carcinoma between July 1996 and March 1999. Additional eligibility criteria for recruitment included: 1) participants identifying as ≥ 18 years of age; 2) the ability to participate in an interview within 9-months post-diagnosis; 3) residence in Bernalillo, Santa Fe, Sandoval, Valencia, or Taos Counties in New Mexico; and 4) self-reported Hispanic or NHW race/ethnicity.

HEAL-NM Study Population

Figure 1 provides a description of subject recruitment, participation, and timing of data collection regarding the primary variables used in this thesis. 999 women were eligible. Out of these women, 616 of them completed the baseline survey, on average, six months post-diagnosis. Participants were asked to complete a follow-up assessment approximately 24 months after baseline. Out of the 616 women who participated in the baseline survey, 591 (95.9%) were eligible to participate in the follow-up assessment at 24-months and 496 (80.5%) completed it. Reasons for non-participation in the 24-month follow-up assessment included: refusal to participate (n=64), unable to interview (n=17) or locate (n=8), and leaving the state (n=6). Of the 591 who participated in the 24-month follow-up, 567 (95.9%) were eligible to participate in the follow-up assessment at 36-months, which included the HRQOL assessment, and 459 (77.7%) completed it. Reasons for non-participation in the 36-month follow up assessment included: no return (n=42), not chosen (n=33), refusal to participate (n=22), unable to interview (n=8), and unable

Figure 1. Study Participation Flow—HEAL Study New Mexico Site

Note: 'never contact' does not mean the women were 'never' contacted but rather somewhere along the way during follow-up these women indicated that they no longer wished to participate.



to locate (n=3). (150). Participants were further contacted for 5-year and 10-year follow-up post-diagnosis; however, data from these assessments are not used for this study. Passive follow-up on all cases occurred by updating survival and cancer diagnosis information regularly through the NMTR. Information on survival and new primaries was available through December 2012 for approximately 12.5 years from baseline assessment.

Participants were eligible for this analysis if they had completed HRQOL assessments and completed data on survival time. Among the 459 women who completed the 36-month HRQOL follow-up, 436 (94.9%) provided complete HRQOL information. Among these 436 participants, none were missing survival time. The analytic sample was restricted to participants who had invasive breast cancer only (Stage I to Stage IIIa). Thus, women who were diagnosed with *in situ* breast carcinoma were excluded (n=85). The final analytic sample size consisted of 351 participants, 78 Hispanic women and 273 NHW women.

Data Collection & Outcome Measures

Data used in this thesis originate from HEAL baseline, 24-month, and 36-month (HRQOL) assessments, medical record abstraction, and Surveillance Epidemiology and End Results (SEER) cancer registry records. Baseline interviews occurred, on average, at 6-months post-diagnosis and were conducted at the University of New Mexico Aging and Genetic Epidemiology Program. Questionnaires measured demographics (age, race/ethnicity, education), lifestyle factors covering Tamoxifen use, smoking status, and

screening practices, as well as anthropometric measurements including BMI, and blood or saliva samples.

At 24-month follow-up, questionnaires measured similar demographics, menstrual status, eating habits, additional breast disease and treatment, medical conditions, hormone replacement therapy, physical activity, smoking habits, and alcohol intake.

At 36-month follow-up, questionnaires measured HRQOL characteristics such as support group experiences, information about breast cancer and surgery, pain, lymphedema, religiosity, optimism, the impact of cancer and changes after cancer, social support, fatigue, sexual activity, life events, fear about recurrence, health status/functioning, perceived stress, and Tamoxifen use.

Demographic and Lifestyle Characteristics

Demographic data collected at baseline and 24-month follow-up and evaluated in this study include age, self-reported race/ethnicity, education, and marital status. Lifestyle factors evaluated include physical activity, smoking status, and Tamoxifen use. Physical activity was measured only at 24-month follow-up while smoking status and Tamoxifen use were measured at both baseline and 24-month follow-up.

Clinical Characteristics

Data on breast cancer diagnoses and breast cancer stage were ascertained using SEER-NMTR, including additional data on tumor size, lymph node involvement, and tumor subtypes (Luminal A, Luminal B, HER2 Overexpressing, Triple Negative), which

were obtained via pathology reports. Information on co-morbid conditions and cancer treatment, such as adjuvant therapy, was abstracted from medical record and SEER-NMTR registry records. This information includes: radiation and/or chemotherapy, types of surgery, and use of Tamoxifen (medically abstracted and self-reported during the 24-month assessment). Participants were passively followed through the SEER NMTR and National Death Index for vital status updates; causes of death, and date of death or date of last contact.

HRQOL Assessment

The following instruments were used to collect HRQOL data at the 36-month follow-up: RAND 36-item Short Form Health Survey (SF-36) (35), Lymphedema Status (added by HEAL investigators), the Life Orientation Test (151), Social Support (152), the Piper Fatigue Scale (153), and Fear of Recurrence Scale (154).

Data from the SF-36 was used to measure eight health components (subscales) and two derived component summary scales (MCS/PCS). Response values from 36 items (questions) were recoded per the scoring key and items in the same scale were averaged to create a measure for each of the eight subscales (35, 155). When scoring occurs, items that are left blank are not included in calculating the scale scores, which are calculated by taking an average of only the completed answers (156). There are four mental/psychosocial subscales (Social Functioning, Role-Emotional, Vitality, and Mental Health) and four physical subscales (Physical Functioning, Role-Physical, Bodily Pain, and General Health). Raw subscale scores range from 0 to 100, higher scores indicating a better HRQOL. The MCS and PCS scores were calculated by using weighted Z-scores of

the eight subscales multiplied by a factor score coefficient and summed over their respective subscales (35, 157). Raw scores of the four psychosocial subscales and the four physical subscales as well as the two component summary scores were normalized to the general U.S. population on a T-score metric (mean = 50, SD ± 10) in order to compare across groups. A score change of ½ a SD had been used to determine the presence of a clinically meaningful difference (35, 157). The SF-36 has been proven reliable with Cronbach's alpha estimates of 0.78 or higher in the MOS (155, 158).

Lymphedema status was determined based on those who ever experienced lymphedema, received treatment for lymphedema, and who were experiencing lymphedema at the time of assessment. The Life Orientation Test provided information on perceived optimism, and conversely, perceived pessimism, both analyzed separately via a 6-item questionnaire (151). Information on the number of types of confidants was utilized from the Social Support aspect of the HRQOL assessment (152). One question pulled from the Piper Fatigue Scale determined current fatigue in participants four weeks prior to assessment (153), and one question about fear of breast cancer recurrence during time of assessment was chosen via the Fear of Recurrence Scale (154).

Optimism, derived from the Life Orientation test, was categorized into two components: perceived pessimism and perceived optimism, based on reverse coding for pessimism in contrast to optimism, and the inherent way the two new concepts differ.

Social support was based on a series of questions about types of confidants at diagnosis and at the time of the interview (i.e., spouse, children, other family members, friends, neighbors, nurses, treating physicians, psychiatrists, psychologists/therapists, priest/rabbis/ministers, support groups, or 'other').

Current fatigue (yes/no) in the four weeks before HRQOL assessment was denoted by a preliminary question in the Piper Fatigue Scale (153). Fear of recurrence was defined by participants who indicated that they were afraid of their cancer returning at the time of HRQOL assessment.

Mortality and Survival Periods

Figure 2 displays a graph of the entire follow-up and survival periods for the population. Mortality, including type of death, of participants was ascertained via the National Death Index. A survival period of one to 12.5 years was used, abstracted from consented passive follow-up through SEER and calculated based on the difference from HRQOL interview to censor date. For this analysis, survival time began at 3-years based on the average completed time for the HRQOL follow-up assessment post-diagnosis. The outcome of interest was mortality, specifically all-cause, breast cancer-specific, and non-cancer mortality.

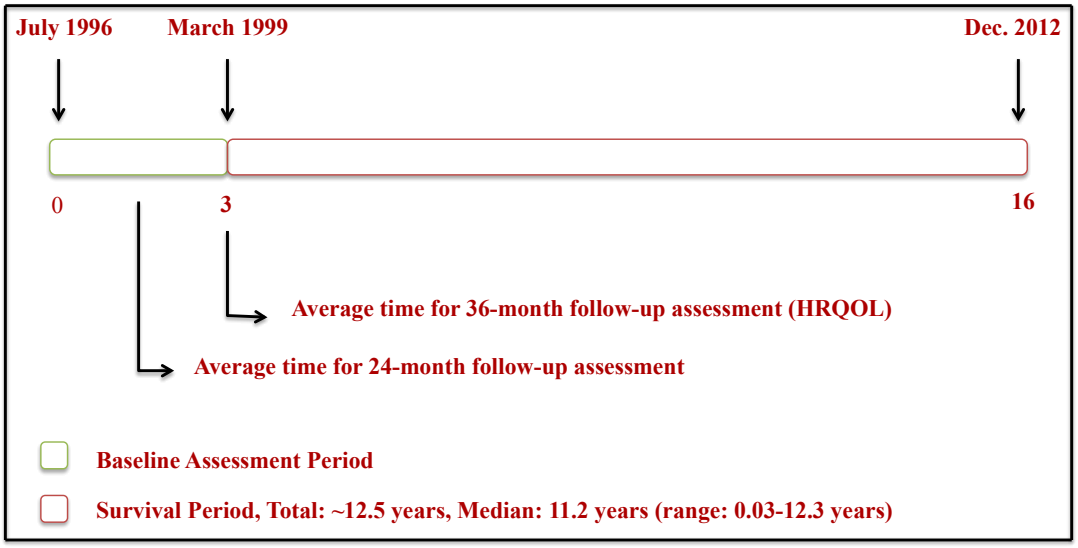


Figure 2. HEAL New Mexico Site Follow-Up and Survival Time.

Statistical Analysis

Eligible Analytic Sample Size

Among the 459 women who completed the 36-month follow-up, 23 were missing complete HRQOL data and 85 were excluded due to a diagnosis *in situ* disease (stage 0). The eligible analytic sample size subsequently consisted of 351 participants (78 Hispanic women and 273 NHW) with complete data on HRQOL assessments, vital status, and cause of death, which were diagnosed with invasive breast cancer (Stage I – Stage IIIA) (Figure 1).

Exposure Assessment

For all-cause and non-cancer mortality, HRQOL subscale and component summary scores were categorized into tertiles with the highest tertile used as the referent group, based on the distribution of the cohort. Because breast cancer-specific mortality had a low number of events, the HRQOL subscale and component summary scores were dichotomized, based on the distribution of the cohort, to increase statistical power.

Outcome Assessment

Outcomes for analyses included all-cause (death due to any cause), breast cancer-specific, and non-cancer (death due to causes other than cancer) mortality as ascertained from death records. For this analysis, participants were passively followed from date of HRQOL interview (approximately 36-months post-diagnosis) to December 2012. International Classification of Diseases, 10th Revision (ICD-10) codes were used to sort causes of deaths (159, 160). For all-cause mortality, the time frame for follow-up was

initiated from HRQOL assessment to the date of death, and non-deceased participants were censored on December 2012. For breast cancer-specific mortality, women dying of breast cancer-related deaths were the outcome of interest and women dying from other causes were censored on December 2012. For non-cancer mortality, women dying of all-causes with exception to cancer-related deaths were the outcome of interest and women dying from cancer were censored on December 2012. Furthermore, participants were censored if they experienced a death, on their date of last contact, or at the end of the study.

Potential Covariates

Covariates were analyzed as either confounders or effect modifiers in the associations between HRQOL and mortality. Covariates analyzed from the baseline assessment included age, race/ethnicity, education, marital status, and BMI. Clinical characteristics considered included tumor stage, tumor size, tumor subtype, treatment type, lymph node involvement, and comorbidities. At 24-month follow-up, covariates selected were physical activity, smoking status, and Tamoxifen Use. Variables considered from the HRQOL assessment were: current lymphedema, perceived optimism, perceived pessimism, types of confidants, current fatigue, current pain, perceived general health, and fear of recurrence.

Among the self-reported baseline characteristics, age was continuous. Race/ethnicity were categorized as NHW or Hispanic. Education was classified into four categories: 1) high school or less; 2) some college; 3) college graduate; and 4) graduate

school. Participants reported whether they were single or married for marital status, and BMI (kg/m^2) was categorized into 1) <25; 2) 25-29; and 3) ≥ 30.

Clinical characteristics were abstracted via medical records or SEER-NMTR. For this analysis, tumor stage was dichotomized into localized (Stage 1) and regional (Stages II-IIIA). Tumor size was dichotomized as <3 centimeters and ≥ 3 centimeters. Tumor subtype was initially classified as luminal A, luminal B, HER2 overexpressing, or triple negative. However, due to a low sample size (missing=51), the covariate was dichotomized as ER+ and ER-. For breast cancer treatment type, there were three categories: any chemotherapy, surgery only, and surgery and radiation. Lymph node involvement was dichotomized as none versus one or more lymph nodes involved, similar to comorbidities, which was categorized as zero versus one or more comorbidity.

For 24-month follow-up covariates, physical activity was categorized as none, light, and moderate or vigorous, and smoking status was classified as never, former smoker, or current smoker. Tamoxifen use was dichotomized as yes/no.

Some of the covariates considered from the HRQOL assessment were dichotomized as yes/no, including current lymphedema, current fatigue, current pain, and fear of recurrence. For perceived optimism/pessimism, identical scores were created based on participants' responses to the three questions for optimism and the three questions for pessimism, categorized as ≤ 10 or > 10, or less versus greater perception. These cut points were chosen based on the distribution of the cohort to allow for adequate numbers of participants in each category. A social support variable, types of confidants, was created and categorized based on the distribution of coded responses, similar to the optimism and pessimism variables. In reference to the types of confidants previously

listed, participants were categorized as having less than four, four to five, or greater or equal to six types of different confidants. Perceived general health, SF-36 item, was dichotomized to include participants who rated their health as fair or poor compared to participants who rated their health as good, very good, or excellent.

Descriptive Characteristics

Descriptive characteristics of participants who completed the HRQOL assessment were compared to those who did not, and by vital status (alive vs. deceased) at the end of the study period among those with complete HRQOL data. Frequencies and percentages were reported for categorical variables and means (SD), medians (min-max), and ranges were reported for continuous variables. Chi-square tests of independence for categorical variables and student t-tests for continuous variables were calculated to determine whether the distributions of the variables differed among the groups compared. Descriptive characteristics of the analytic sample were computed by vital status, and the same tests were computed to compare alive and deceased participants.

Statistical Model Building

Cox proportional hazards regression models were used to examine the statistical associations of HRQOL component summary scores with mortality. Hazard Ratios (HR) and 95% Confidence Intervals (CI) were estimated for each outcome. A HR measures how much greater a death rate is in one group compared to another group, using survival times as a comparison between the two groups of participants (161). The time metric in

all analyses was survival years. The referent group for MCS and PCS scores was tertile 3 (T3) and HR 95% CIs were estimated for tertile 1 (T1) and tertile 2 (T2).

Crude HRs between the exposure, MCS scores and PCS scores, and mortality outcomes were calculated. To determine potential confounders for consideration in the model building process, each variable was added to the crude model and a percent change was calculated between each adjusted model and crude model to determine the individual magnitude of effect by each covariate.

A base model (Model 1) was established to assess additional associations between the crude model and Model 1, the crude model and Model 1 plus each covariate, and Model 1 and Model 1 plus each covariate. The base model included age, marital status, and tumor stage, and was the same for both MCS scores and PCS scores. Age and marital status was chosen based on their magnitude of effect when added to the crude model for both MCS and PCS scores. Tumor stage was selected to include a clinical characteristic into the model, and this variable was the only one with no missing values.

Purposeful selection of covariates was employed to evaluate potential confounders yielding p-values less than 0.25 during the univariate analyses (162). This is utilized to identify variables that may not show significant associations between the exposure and outcome alone, but may make a relevant contribution alongside other variables (162). For MCS and PCS scores, respectively, covariates were added to the model one at a time to evaluate the change in association between the crude model and Model 1, the crude model and Model 1 plus a group of covariates, and Model 1 and Model 1 plus a group of covariates. For variables with missing data, data subsets were created to include only participants with complete data, and then the same previous

evaluations were repeated to assess relationships among each model. This step was repeated for each variable with missing data. Final models for associations between MCS scores and all-cause/non-cancer mortality and PCS scores and all-cause/non-cancer mortality were developed depending on the results from the multivariable modeling. These variables were already selected based on the purposeful selection algorithm, and then were further evaluated in conjunction to see their magnitude of effects. Since each variable with missing data (education, lymph node involvement, tumor size, physical activity, Tamoxifen use, smoking status, BMI, and tumor subtype), when considered, did not hold much effect on the associations between the exposures and outcomes, in conjunction with other considered variables, they were excluded. This enabled us to retain a parsimonious model while accounting for covariates that drive the confounding effects. MCS and PCS scores were adjusted for different variables based on their confounding effects in the model building process. Breast cancer-specific multivariable modeling building was not conducted to a low sample of events and no significant results. The final analytic sample size was (N = 351) (Figure 1). Tables detailing the statistical modeling process can be found in Appendices (B-O).

Least Squares Means

Means (SD) and adjusted least-squares means (LSMs) for HRQOL subscales and MCS and PCS categories were calculated stratified by mortality outcome. For breast cancer-specific and non-cancer mortality, participants who died from causes other than breast-cancer specific or non-cancer, respectively, were excluded from the analyses. HRQOL subscales were adjusted for covariates associated with either MCS or PCS, and

these include age, race/ethnicity, tumor stage, education, BMI, treatment type, lymph node involvement, co-morbid conditions, physical activity, current lymphedema, perceived pessimism, number of types of confidants, and fear of recurrence. Tukey-Kramer p-values were computed to compare HRQOL LSMs between participants who were deemed alive or dead during the study period. Frequencies (n%) and medians (min-max) were reported for MCS and PCS by vital status and Kruskal-Wallis tests were calculated to evaluate differences among participants by vital status (alive, dead) in the study period.

Survival Curves

Kaplan-Meier survival curves were generated to show the survival rates between MCS and all-cause/breast cancer-specific/non-cancer mortality, and PCS and all-cause/breast cancer-specific/non-cancer mortality for all women, and by race/ethnicity. Survival curves between MCS/PCS tertiles and the three mortality outcomes were compared via log rank test p-values. The curves show survival times (time-to-event) by each tertile and with each death as the event, respectively. Censored participants, or participants who have the "event" or another censoring characteristics such as date of last contact or the end of the study, were displayed as ticks on each curve.

Cox Proportional Hazards Regression

Associations from three models were reported: Model 1, the crude associations, Model 2 adjusted for demographic (age, race/ethnicity, marital status) and clinical characteristics (tumor stage, treatment type, co-morbid conditions), and Model 3,

adjusted for every covariate in Model 2, in addition to variables assessed during the HRQOL follow-up (current lymphedema, perceived optimism/pessimism, types of confidants, bodily pain, perceived general health, and fear of recurrence. P-trends were calculated to test the ordered relationship across the three MCS and PCS tertiles (163).

To evaluate effect modification, Cox Proportional hazard regression models investigated associations between MCS and mortality and PCS and mortality, stratified by race/ethnicity (NHW, Hispanic), and these associations were adjusted for every covariate (Model 3 only). Additional analyses evaluated the associations between individual HRQOL subscales scores and all-cause, breast cancer-specific, and non-cancer mortality, using the three step modeling procedure previously mentioned, adjusted for the same variables for MCS (mental/psychosocial-related) and PCS (physical-related), respectively. Models with breast cancer-specific mortality as the outcome variable were adjusted for the same covariates for all-cause mortality evaluations.

The proportional hazards assumption is that each covariate added to cox proportional hazard models do not vary with time (164). Violation of the proportional hazards assumption was evaluated using Schoenfeld Residuals testing (164, 165). Each variable was assessed using a time-dependent covariate method, adding interaction terms to test for their significance (164). P-values were generated for each covariate as well as one for the total model. P-values <0.05 were considered significant and as a violation of the proportional hazards assumption.

Data were analyzed using SAS 9.4 (Cary, N.C.).

RESULTS

Participant Characteristics

Demographic and clinical characteristics of the entire HEAL-NM cohort by HRQOL assessment completion status are presented in Table 1. Of those that died prior to the HRQOL assessment, a majority died from breast cancer-specific mortality (n=47/100). Among the 615 participants who completed the baseline survey, 436 (70.9%) completed the HRQOL assessment while 179 (29.1%) did not. The 179 participants who did not complete the HRQOL assessment were either deceased or ineligible by the assessment date, or did not fully complete the HRQOL assessment. Of those who completed the assessment, many were younger (mean age: 58.5 ± 11.7) compared to their counterparts (mean age: 60.8 ± 14.6), p=0.0390. Additionally, cause of death significantly differed between the two groups (p=0.0019). People who completed the HRQOL assessment experienced more all-cause and non-cancer-related deaths but less breast cancer-specific deaths compared to people who did not fully complete the assessment. HRQOL status groups also differed by characteristics at both baseline, including race/ethnicity (p=0.0069), education (p=0.0005), marital status (p=<0.0001), lymph node involvement (p=0.0288); and 24-month follow-up, including Tamoxifen use (p=0.0206), significantly differed.

Table 2 displays demographic, clinical, and HRQOL characteristics of the analytic sample (N=351) by vital status (all-cause mortality only) at the end of the study

Table 1. Demographic Characteristics of HEAL Participants Who Completed the HRQOL Assessment Compared to Non-respondents, The HEAL Study New Mexico Site (*N* = 615)

Characteristics *N*(%)[a]	Total Population (*N* = 615)	HRQOL Assessment		*P*[a]
		Completed (*n* = 436)	Not Completed (*n* = 179)	
Baseline				
Age (years)				*0.0390*
Mean ± (SD)	59.2 ± 12.6	58.5 ± 11.7	60.8 ± 14.6	
Median (min-max)	58 (29-91)	57 (29-86)	61 (35-91)	
Race/Ethnicity				*0.0069*
Non-Hispanic White	461 (75.0)	340 (78.0)	121 (67.6)	
Hispanic	154 (25.0)	96 (22.0)	58 (32.4)	
Education				*0.0005*
High school or less	184 (29.9)	109 (25.0)	75 (41.9)	
Some college	197 (32.0)	146 (33.5)	51 (28.5)	
College graduate	110 (17.9)	86 (19.7)	24 (13.4)	
Graduate school	123 (20.0)	94 (21.6)	29 (16.2)	
Missing	1 (0.2)	1 (0.2)	0 (0.0)	
Marital status				*<0.0001*
Single	321 (52.2)	190 (43.6)	131 (73.2)	
Married	294 (47.8)	246 (56.4)	48 (26.8)	
Body Mass Index (kg/m^2)				0.9708
< 25	268 (43.6)	194 (44.5)	74 (41.4)	
25-29	185 (30.1)	132 (30.3)	53 (29.6)	
≥ 30	110 (17.9)	79 (18.1)	31 (17.3)	
Missing	52 (8.4)	31 (7.1)	21 (11.7)	
Tumor Stage				0.2587
In-Situ (0)	118 (19.2)	85 (19.5)	33 (18.4)	
Localized (I)	381 (61.9)	276 (63.3)	105 (58.7)	
Regional (II-IIIa)	116 (18.9)	75 (17.2)	41 (22.9)	
Tumor Size (cm)				0.1005
<3 cm	503 (81.8)	364 (83.5)	139 (77.7)	
≥ 3 cm	64 (10.4)	40 (9.2)	24 (13.4)	
Missing	48 (7.8)	32 (7.3)	16 (8.9)	
Tumor Subtype				0.4567
Luminal A	220 (35.8)	153 (35.1)	67 (37.4)	
Luminal B	131 (21.3)	98 (22.5)	33 (18.4)	
HER2 Overexpressing	34 (5.5)	21 (4.8)	13 (7.3)	
Triple Negative	41 (6.7)	28 (6.4)	13 (7.3)	
Missing	189 (30.7)	136 (31.2)	53 (29.6)	
Breast Cancer Treatment Type				0.4532

Characteristics *N*(%)[a]	Total Population (*N* = 615)	HRQOL Assessment		*P*[a]
		Completed (*n* = 436)	Not Completed (*n* = 179)	
Any chemotherapy	151 (24.6)	109 (25.0)	42 (23.5)	
Surgery only	214 (34.8)	145 (33.3)	69 (38.5)	
Surgery and radiation	250 (40.6)	182 (41.7)	68 (38.0)	
Lymph Node Involvement				*0.0288*
None	477 (77.6)	349 (80.0)	128 (71.5)	
≥ 1 Lymph Nodes Involved	122 (19.8)	77 (17.7)	45 (25.1)	
Missing	16 (2.6)	10 (2.3)	6 (3.4)	
Charlson Comorbidity Index				0.0658
No co-morbid conditions	508 (82.6)	368 (84.4)	140 (78.2)	
One or more conditions	107 (17.4)	68 (15.6)	39 (21.8)	
24-month follow-up				
Physical Activity				0.3176
None	286 (46.5)	229 (52.5)	57 (31.8)	
Light	88 (14.3)	74 (17.0)	14 (7.8)	
Moderate	25 (4.1)	22 (5.0)	3 (1.7)	
Vigorous	96 (15.6)	84 (19.3)	12 (6.7)	
Missing	120 (19.5)	27 (6.2)	93 (52.0)	
Smoking Status				0.5858
Never	222 (36.1)	186 (42.7)	36 (20.1)	
Former	212 (34.5)	171 (39.2)	41 (22.9)	
Current	61 (9.9)	52 (11.9)	9 (5.0)	
Missing	120 (19.5)	27 (6.2)	93 (52.0)	
Tamoxifen Use				*0.0206*
No	290 (47.2)	230 (52.7)	60 (33.5)	
Yes	205 (33.3)	179 (41.1)	26 (14.5)	
Missing	120 (19.5)	27 (6.2)	93 (52.0)	
Vital Status				*0.0019*
Alive	400 (65.0)	321 (73.6)	79 (44.1)	
Death, Breast cancer-specific	74 (12.0)	27 (6.2)	47 (26.3)	
Death, Non-cancer	123 (20.0)	78 (17.9)	47 (26.3)	
Death, All-cause	215 (35.0)	115 (26.4)	100 (55.9)	

[a] Chi-square p-value for categorical variables or t-test p-values for continuous variables comparing participants who have completed the HRQOL assessment and participants who have not, excluding missing values. An *italicized* p-value represents statistically significant differences between comparison groups.

Note: Reasons for not completing the HRQOL assessment were refusal and ineligibility (i.e. death).

period. Ninety-nine participants were deceased. 64 died from non-cancer causes, and 26 died from breast cancer-specific causes. The median survival time was 11.2 years (range: 0.03-12.3 years). Several baseline characteristics differed by vital status. Mean age for participants who were alive was significantly younger than those who died (56.1 ± 10.4 vs. 65.2 ± 12.7, respectively). Of the total sample, 273 (75.4%) reported NHW race while 78 (22.2%) reported Hispanic origin. The majority of the population indicated having completed some college (32.5%) and high school or less (26.2%), similar results were observed by vital status. The distribution of BMI was about the same by vital status. Almost half of the study population had a BMI of less than 25kg/m^2 (45.9%).

Marital status significantly differed by vital status (p=0.0004), the majority of deceased women were single (60.6%). Two hundred seventy six participants (78.6%) presented with localized (I) tumor stage, 75 (21.4%) were diagnosed with regional (II-IIIa) stages. Most participants had a smaller tumor size <3cm (86.6%) compared to ≥3cm (10.5%). In terms of tumor subtypes, the majority was diagnosed with ER+ subtypes (71.5%) compared to ER- (14%); however, 14.5% were missing this information. Among all women in the study, most received surgery only (41.0%), followed by any chemotherapy (31.1%) and then surgery and radiation (27.9%). Furthermore, about 75% of the population had no lymph node involvement (75.2%). Tumor stage, size, and subtype, treatment type, and lymph node involvement did not significantly differ by vital status (p=-0.41, 0.63, 0.81, 0.24, 0.35, respectively). Approximately 85% of the cohort had zero comorbid conditions. The distribution of comorbidities significantly differed by vital status (p=0.0076), those who were deceased were more likely to have ≥1 comorbid condition compared to those who were alive (23.2% vs. 11.9%, respectively). Variables

ascertained from the 24-month follow-up assessment were physical activity, smoking status, and Tamoxifen use. Twenty one participants were missing these three variables. Levels of physical activity significantly differed between living and deceased participants

Table 2. Demographic Characteristics of HEAL Participants with Invasive Breast Cancer by Vital Status (*N* = 351)

Characteristics *N*(%)[a]	Total Population (*N* = 351)	Vital Status		*P*[a]
		Alive (*n* = 252)	Deceased (*n* = 99)	
Baseline				
Age (years)				*<0.0001*
Mean ± (SD)	58.6 ± 11.8	56.1 ± 10.4	65.2 ± 12.7	
Median (min-max)	58 (29-86)	55 (29-83)	68 (32-86)	
Race/Ethnicity				0.0869
Non-Hispanic White	273 (77.8)	190 (75.4)	83 (83.8)	
Hispanic	78 (22.2)	62 (24.6)	16 (16.2)	
Education				0.0534
High school or less	92 (26.2)	61 (24.2)	31 (31.3)	
Some college	114 (32.5)	76 (30.2)	38 (38.4)	
College graduate	70 (19.9)	57 (22.6)	13 (13.1)	
Graduate school	74 (21.1)	58 (23.0)	16 (16.2)	
Missing	1 (0.3)	0 (0.0)	1 (1.0)	
Marital status				*0.0004*
Single	160 (45.6)	100 (39.7)	60 (60.6)	
Married	191 (54.4)	152 (60.3)	39 (39.4)	
Body Mass Index (kg/m^2)				0.2450
< 25	161 (45.9)	121 (48.0)	40 (40.4)	
25-29	99 (28.2)	76 (30.2)	23 (23.2)	
≥ 30	64 (18.2)	42 (16.7)	22 (22.2)	
Missing	27 (7.7)	13 (5.1)	14 (1.2)	
Tumor Stage				0.4102
Localized (I)	276 (78.6)	201 (79.8)	75 (75.8)	
Regional (II-IIIa)	75 (21.4)	51 (20.2)	24 (24.2)	
Tumor Size (cm)				0.6294
<3 cm	304 (86.6)	217 (86.1)	87 (87.9)	
≥ 3 cm	37 (10.5)	25 (9.9)	12 (12.1)	
Missing	10 (2.9)	10 (4.0)	0 (0.0)	
Tumor Subtype				0.8132
Luminal A	153 (43.6)	109 (43.3)	44 (44.4)	
Luminal B	98 (27.9)	71 (28.2)	27 (27.3)	

Characteristics *N*(%)[a]	Total Population (*N* = 351)	Vital Status		*P*[a]
		Alive (*n* = 252)	Deceased (*n* = 99)	
HER2 Overexpressing	21 (6.0)	13 (5.2)	8 (8.1)	
Triple Negative	28 (8.0)	20 (7.9)	8 (8.1)	
Missing	51 (14.5)	39 (15.5)	12 (12.1)	
Breast Cancer Treatment Type				0.2433
Any chemotherapy	109 (31.1)	81 (32.1)	28 (28.3)	
Surgery only	144 (41.0)	107 (42.5)	37 (37.4)	
Surgery and radiation	98 (27.9)	64 (25.4)	34 (34.3)	
Lymph Node Involvement				0.3466
None	264 (75.2)	196 (77.8)	68 (68.7)	
≥ 1	77 (21.9)	53 (21.0)	24 (24.2)	
Missing	10 (2.9)	3 (1.2)	7 (7.1)	
Charlson Comorbidity Index				*0.0076*
No co-morbid conditions	298 (84.9)	222 (88.1)	76 (76.8)	
One or more conditions	53 (15.1)	30 (11.9)	23 (23.2)	
24-Month follow-up				
Physical Activity				*0.0243*
None	185 (52.7)	123 (48.8)	62 (62.6)	
Light	59 (16.8)	47 (18.7)	12 (12.1)	
Moderate/Vigorous	86 (24.5)	69 (27.4)	17 (17.2)	
Missing	21 (6.0)	13 (5.1)	8 (8.1)	
Smoking Status				0.8182
Never	145 (41.3)	106 (42.1)	39 (39.4)	
Former	144 (41.0)	105 (41.7)	39 (39.4)	
Current	41 (11.7)	28 (11.1)	13 (13.1	
Missing	21 (6.0)	13 (5.1)	8 (8.1)	
Tamoxifen Use				0.4780
No	160 (45.6)	113 (44.8)	47 (47.5)	
Yes	170 (48.4)	126 (50.0)	44 (44.4)	
Missing	21 (6.0)	13 (5.2)	8 (8.1)	
HRQOL (36-month) follow-up				
Current lymphedema				0.2219
No	307 (87.5)	217 (86.1)	90 (90.9)	
Yes	44 (12.5)	35 (13.9)	9 (9.1)	
Perceived Optimism Score				*0.0341*
≤ 10	83 (23.7)	52 (20.6)	31 (31.3)	
> 10	268 (76.3)	200 (79.4)	68 (68.7)	
Perceived Pessimism Score				*0.0176*
≤ 10	255 (72.6)	192 (76.2)	63 (63.6)	

Characteristics *N*(%)[a]	Total Population (*N* = 351)	Vital Status		*P*[a]
		Alive (*n* = 252)	Deceased (*n* = 99)	
> 10	96 (27.4)	60 (23.8)	36 (36.4)	
Number of Types of Confidants				0.1021
<4 people	66 (18.8)	41 (16.3)	25 (25.2)	
4-5 people	172 (49.0)	124 (49.2)	48 (48.5)	
≥ 6 people	113 (32.2)	87 (34.5)	26 (26.3)	
Current Fatigue				0.9304
No	136 (38.8)	98 (38.9)	38 (38.4)	
Yes	215 (61.2)	154 (61.1)	61 (61.6)	
Current Pain				*0.0270*
No	93 (26.5)	75 (29.8)	18 (18.2)	
Yes	258 (73.5)	177 (70.2)	81 (81.8)	
Perceived General Health				*<0.0001*
Fair/Poor	54 (15.4)	26 (10.3)	28 (28.3)	
Good/Very Good/Excellent	297 (84.6)	226 (89.7)	71 (71.7)	
Fear of Recurrence				*0.0407*
No	154 (43.9)	102 (40.5)	52 (52.5)	
Yes	197 (56.1)	150 (59.5)	47 (47.5)	
Cause of Death				
Breast cancer-specific		--	26 (26.3)	
Other-cancer		--	9 (9.1)	
Non-cancer		--	64 (64.6)	

[a] Chi-square p-value for categorical variables or t-test p-values for continuous variables comparing participants who have completed the HRQOL assessment and participants who have not, excluding missing values. An *italicized* p-value represents statistically significant differences between comparison groups.

(p=0.0243), where more women who were alive exercised in moderate or vigorous quantities (27.4%) compared to their deceased counterparts (17.2%). Forty-one percent of the population reported never smoked, 41% reported being a former smoker, 11.7% were current smokers, and 6% were missing data for smoking. Approximately half of the cohort reported never using Tamoxifen (48.4%). Among variables ascertained from HRQOL assessment, perceived optimism score (p=0.0341), perceived pessimism score (p=0.0176), current pain (p=0.0270), perceived general health (p=<0.0001), and fear of

recurrence (p=0.0407) significantly differed by vital status. Deceased women had higher proportions of reporting worse aspects of HRQOL variables.

HRQOL Subscale and Component Summary Scores

Comparisons of HRQOL subscale and component summary scores by vital status by mortality outcomes are presented in Table 3. When stratified by all-cause mortality, one mental/psychosocial subscale and three physical subscales differed by vital status. The mean ± SD (adjusted least square means (LSM)) for the mental subscale, social functioning, was among those who were alive and was higher 50.16 ± 9.48 (47.83) compared to those who died 45.68 ± 11.21 (43.89), p=0.0030. MCS did not differ by vital status and mortality outcomes.

Of the physical subscales that differed by vital status, those who were alive also had significantly higher adjusted LSM compared to those who died: physical functioning (39.27 vs. 35.38, respectively), role physical (40.55 vs. 37.32, respectively), and bodily pain (45.89 vs. 42.43, respectively). The PCS significantly differed by vital status (41.97 vs. 38.31, respectively, p=0.0037), but the MCS did not (p=0.2093).

For breast cancer-specific mortality, 73 participants were excluded from the analyses due to dying by other causes. Among participants who were alive and participants who died by breast cancer specific mortality, no significant associations were found. Similarly, 35 participants were excluded from analyses comparing HRQOL subscale and component summary scores by non-cancer mortality. Of the

Table 3. Comparisons of HRQOL SF-36 Subscale and Component Summary Scores by Vital Status (*N* = 351)

		Mortality Outcomes							
		All-Cause			Breast Cancer-Specific[b]			Non-Cancer[b]	
HRQOL SF-36	Total (*N* = 351)	Alive (*n* = 252)	Deceased (*n* = 99)	*P*[d]	Alive (*n* = 252)	Deceased (*n* = 26)	*P*[d]	Alive (*n* = 252)	Deceased (*n* = 64)	*P*[d]
SF-36 Subscales										
Social Functioning				*0.0030*			0.8089			*0.0001*
Mean ± SD	48.89 ± 10.18	50.16 ± 9.48	45.68 ± 11.21		50.16 ± 9.48	49.20 ± 9.37		50.16 ± 9.48	44.24 ± 11.50	
LSM[c]		47.83	43.89		46.80	47.29		49.62	43.32	
Role Emotional				0.3707			0.9736			0.1772
Mean ± SD	45.26 ± 11.76	46.19 ± 11.64	42.89 ± 11.79		46.19 ± 11.64	44.40 ± 11.72		46.19 ± 11.64	42.17 ± 12.02	
LSM[c]		42.66	41.28		42.65	42.56		45.14	42.55	
Vitality				0.0540			0.4866			*0.0054*
Mean ± SD	48.74 ± 10.22	49.61 ± 10.33	46.52 ± 9.64		49.61 ± 10.33	49.51 ± 8.65		49.61 ± 10.33	45.39 ± 10.13	
LSM[c]		43.20	40.64		44.28	45.76		45.55	40.94	
Mental Health				0.0756			0.7542			*0.0171*
Mean ± SD	48.93 ± 9.73	49.44 ± 9.81	47.62 ± 9.46		49.44 ± 9.81	48.43 ± 9.67		49.44 ± 9.81	47.28 ± 9.65	
LSM[c]		42.19	40.08		45.55	44.93		44.80	41.34	
Physical Functioning				*0.0026*			0.4875			*0.0004*
Mean ± SD	45.82 ± 11.27	48.17 ± 9.66	39.82 ± 12.80		48.17 ± 9.66	46.66 ± 10.47		48.17 ± 9.66	37.34 ± 13.17	
LSM[c]		39.27	35.38		41.22	42.57		41.26	35.78	
Role Physical				*0.0256*			0.4003			*0.0032*
Mean ± SD	45.36 ± 11.35	47.09 ± 10.79	40.96 ± 11.60		47.09 ± 10.79	46.72 ± 9.58		47.09 ± 10.79	38.78 ± 11.95	
LSM[c]		40.55	37.32		41.43	43.34		43.14	37.90	
Bodily Pain				*0.0099*			0.5065			*0.0017*
Mean ± SD	50.57 ± 10.49	51.83 ± 10.17	47.39 ± 10.66		51.83 ± 10.17	51.09 ± 9.45		51.83 ± 10.17	46.18 ± 11.08	
LSM[c]		45.89	42.43		47.40	48.83		48.38	43.24	
General Health				0.1588			0.7916			*0.0110*

		Mortality Outcomes								
		All-Cause			Breast Cancer-Specific[b]			Non-Cancer[b]		
	Total	Alive	Deceased		Alive	Deceased		Alive	Deceased	
HRQOL SF-36	(*N* = 351)	(*n* = 252)	(*n* = 99)	*P*[d]	(*n* = 252)	(*n* = 26)	*P*[d]	(*n* = 252)	(*n* = 64)	*P*[d]
Mean ± SD	49.51 ± 10.45	50.58 ± 9.86	46.79 ± 11.41		50.58 ± 9.86	50.31 ± 10.92		50.58 ± 9.86	45.34 ± 11.15	
LSM[c]		42.76	40.90		45.83	45.26		45.07	41.03	
Component Summary Scores										
Mental Component Summary (MCS)				0.2093			0.7879			0.0504
Mean ± SD	48.31 ± 10.25	48.62 ± 10.54	47.54 ± 9.46		48.62 ± 10.54	47.54 ± 10.24		48.62 ± 10.54	47.39 ± 9.31	
LSM[c]		44.98	43.35		44.02	44.57		47.30	44.19	
Physical Component Summary (PCS)				*0.0037*			0.2107			*0.0002*
Mean ± SD	47.78 ± 10.50	49.77 ± 9.43	42.70 ± 11.39		49.77 ± 9.43	49.27 ± 10.44		49.77 ± 9.43	40.33 ± 10.93	
LSM[c]		41.97	38.31		43.64	46.05		44.10	38.47	

[a.] Data collected at 36-month HRQOL follow-up assessment.

[b.] Seventy-three participants were excluded from breast cancer-specific analyses and 35 participants were excluded from non-cancer analyses, both due to death by other causes.

[c.] Least square means adjusted for covariates associated with either MCS or PCS (excluding characteristics involved in the creation of the summary scores). These include baseline (age, race/ethnicity, tumor stage, education, BMI, treatment type, lymph node involvement and comorbidities), 24-month follow-up (physical activity), and 36-month follow-up (current lymphedema, perceived pessimism, number of types of confidants, and fear of recurrence) characteristics. LSMs for breast cancer-specific mortality were adjusted for the same covariates as all-cause mortality due to a low sample size and inability to discern true confounding effects. For Non-cancer mortality perceived pessimism to perceived optimism were added.

[d.] Tukey-Kramer adjusted comparison of least square means between alive and deceased participants. An *italicized* p-value represents statistically significant differences between comparison groups.

mental/psychosocial subscales that differed by non-cancer mortality, participants who were alive had significantly higher adjusted LSM compared to those who died: social functioning (49.62 vs. 43.32, respectively), vitality (45.55 vs. 40.94, respectively), and mental health (44.80 vs. 41.34, respectively).

All of the physical subscales and the PCS significantly differed by non-cancer mortality. Participants who were alive had higher adjusted LSM compared to those who died: physical functioning (41.26 vs. 35.78, respectively), role physical (43.14 vs. 37.90, respectively), bodily pain (48.38 vs. 43.24, respectively), general health (45.07 vs. 41.03, respectively), and PCS (44.10 vs. 38.47, respectively, p=0.0002). The MCS did not significantly differ by non-cancer mortality (p=0.0504).

Associations between HRQOL and All-Cause Mortality

MCS/PCS and All-Cause Mortality

Results from multivariable Cox Proportional Hazard regression models assessing the association between PCS and MCS tertiles and the likelihood of dying of any cause can be found in Table 5. For all regression analyses, three models were analyzed. (See Methods Section, Statistical Analysis, Cox Proportional Hazards Regression for covariates included.) Compared to PCS T3, cases in PCS T1 had an almost four-fold increased risk of dying (HR: 3.80, 95% CI: 2.20, 6.54; p-trend=<0.0001) of any cause. After adjustment for baseline lifestyle and clinical characteristics, this association attenuated towards the null but remained significant (HR: 2.12, 95% CI: 1.18, 3.81; p-trend=0.0053). Furthermore, when adjusted for HRQOL characteristics, the risk of dying of any causes did not change (HR: 2.17, 95% CI; 1.20, 3.90; p-trend=0.0061). No

Table 4. Comparisons of HRQOL SF-36 Component Summary Score Tertiles by Vital Status (*N* = 351)

		Mortality Outcomes								
		All-Cause			Breast Cancer-Specific[b, e]			Non-Cancer[b]		
Component Summary Scores[a]	Total (*N* = 351)	Alive (*n* = 252)	Deceased (*n* = 99)	*P*[d]	Alive (*n* = 252)	Deceased (*n* = 26)	*P*[d]	Alive (*n* = 252)	Deceased (*n* = 64)	*P*[d]
Mental Component Summary (MCS)										
T1				0.4933			0.7324			0.4640
n(%)	117 (33.3)	81 (32.2)	36 (36.4)		120 (47.6)	14 (53.8)		81 (32.2)	23 (35.9)	
Median	37.4	36.9	38.4		41.8	42.2		36.9	38.1	
(min-max)[c]	(12.8-45.1)	(12.8-45.1)	(21.9-44.0)		(12.8-50.6)	(26.0-48.7)		(12.8-45.1)	(21.9-44.0)	
T2				0.1080			0.9481			0.1493
n(%)	117 (33.3)	82 (32.5)	35 (35.3)		132 (52.4)	12 (46.2)		82 (32.5)	24 (37.5)	
Median	50.6	50.9	48.7		56.6	57.5		50.9	48.5	
(min-max)[c]	(45.2-54.4)	(45.2-54.4)	(45.2-54.4)		(50.7-68.6)	(50.7-59.5)		(45.2-54.4)	(45.2-54.4)	
T3				0.5313			--			0.3285
n(%)	117 (33.3)	89 (35.3)	28 (28.3)		--	--		89 (35.3)	17 (26.6)	
Median	57.9	57.9	57.9		--	--		57.9	57.6	
(min-max)[c]	(54.4-68.6)	(54.8-68.6)	(54.4-64.9)					(54.8-68.6)	(54.4-64.9)	
Physical Component Summary (PCS)										
T1				0.1037			0.8715			0.0992
n(%)	117 (33.3)	62 (24.6)	55 (55.5)		109 (43.3)	13 (50.0)		62 (24.6)	43 (67.2)	
Median	35.1	36.1	33.8		43.7	44.8		36.1	32.8	
(min-max)[c]	(19.6-44.8)	(23.1-44.8)	(19.6-44.6)		(23.1-50.3)	(29.1-48.8)		(23.1-44.8)	(19.6-44.6)	
T2				0.9278			0.8500			0.1672
n(%)	117 (33.3)	90 (35.7)	27 (27.3)		143 (56.7)	13 (50.0)		90 (35.7)	12 (18.8)	
Median	50.3	50.2	50.3		56.1	56.7		50.2	51.6	
(min-max)[c]	(44.8-54.4)	(44.8-54.4)	(44.8-54.1)		(50.3-66.8)	(50.3-71.4)		(44.8-54.4)	(48.4-54.1)	
T3				0.9938			--			0.0693

		Mortality Outcomes								
		All-Cause			Breast Cancer-Specific[b, e]			Non-Cancer[b]		
	Total	Alive	Deceased		Alive	Deceased		Alive	Deceased	
Component Summary Scores[a]	(*N* = 351)	(*n* = 252)	(*n* = 99)	*P*[d]	(*n* = 252)	(*n* = 26)	*P*[d]	(*n* = 252)	(*n* = 64)	*P*[d]
n(%)	117 (33.3)	100 (39.7)	17 (17.2)		--	--		100 (39.7)	9 (14.0)	
Median	57.3	57.4	57.3		--	--		57.4	56.2	
(min-max)[c]	(54.5-71.4)	(54.6-66.8)	(54.5-71.4)					(54.6-66.8)	(54.5-61.5)	

[a.] Data collected at 36-month HRQOL follow-up assessment.

[b.] Seventy-three participants were excluded from breast cancer-specific analyses and 35 participants were excluded from non-cancer analyses, both due to death by other causes.

[c.] Min-max values may overlap due to rounding.

[d.] Kruskal-Wallis tests comparing median values between alive and deceased.

[e.] T1/T2 for Breast Cancer-Specific outcomes are dichotomies defined as 'low' and 'high'. HRQOL scores, T3 is defined as 'high' HRQOL scores.

significant associations between MCS T1 vs. T3 and MCS T2 vs. T3 were observed; however all models were suggestive of an increased risk of dying of any cause.

Table 5. Associations between HRQOL SF-36 Mental & Physical Component Summary Score Tertiles and All-Cause Mortality (*N* = 351)

	Model 1[c]		
HRQOL Component Summary Scores[a]	# of Deaths (Total)[b]	HR (95% CI)	*P* Trend
MCS			0.2238
T1 (≤ 45.12)	36 (117)	1.36 (0.83, 2.23)	
T2 (>45.12 & ≤54.40)	35 (117)	1.25 (0.76, 2.06)	
T3 (>54.40)	28 (117)	1.00 (ref)	
PCS			*<0.0001*
T1 (≤ 44.75)	55 (117)	**3.80 (2.20, 6.54)**	
T2 (>44.75 & ≤54.39)	27 (117)	1.67 (0.91, 3.07)	
T3 (>54.39)	17 (117)	1.00 (ref)	
	Model 2[d]		
HRQOL Component Summary Scores[a]	# of Deaths (Total)[b]	HR (95% CI)	*P* Trend
MCS			0.1139
T1 (≤ 45.12)	36 (117)	1.51 (0.90, 2.53)	
T2 (>45.12 & ≤54.40)	35 (117)	1.27 (0.77, 2.10)	
T3 (>54.40)	28 (117)	1.00 (ref)	
PCS			*0.0053*
T1 (≤ 44.75)	55 (117)	**2.12 (1.18, 3.81)**	
T2 (>44.75 & ≤54.39)	27 (117)	1.26 (0.68, 2.35)	
T3 (>54.39)	17 (117)	1.00 (ref)	
	Model 3[e]		
HRQOL Component Summary Scores[a]	# of Deaths (Total)[b]	HR (95% CI)	*P* Trend
MCS			0.4284
T1 (≤ 45.12)	36 (117)	1.24 (0.72, 2.15)	
T2 (>45.12 & ≤54.40)	35 (117)	1.26 (0.76, 2.10)	
T3 (>54.40)	28 (117)	1.00 (ref)	

HRQOL Component Summary Scores[a]	# of Deaths (Total)[b]	Model 3[e] HR (95% CI)	*P* Trend
PCS			*0.0061*
T1 (≤ 44.75)	55 (117)	**2.17 (1.20, 3.90)**	
T2 (>44.75 & ≤54.39)	27 (117)	1.37 (0.74, 2.56)	
T3 (>54.39)	17 (117)	1.00 (ref)	

[a.] Data collected at 36-month HRQOL follow-up assessment.

[b.] Frequency of # of events and total number within the category.

[c.] **Model 1,** crude.

[d.] **Model 2** adjusted for baseline lifestyle and clinical characteristics. MCS: age, race/ethnicity, marital status, tumor stage, treatment type, and comorbidities; PCS: age, race/ethnicity, marital status, tumor stage, treatment type, and comorbidities.

[e.] **Model 3** adjusted for additional HRQOL characteristics in addition to Model 1. MCS: current lymphedema, perceived pessimism, number of types of confidants, bodily pain, and perceived general health. PCS: current lymphedema, perceived pessimism, number of types of confidants, fear of recurrence.

Abbreviations: HRQOL, Healthy-Related Quality of Life; HR, hazard ratio; CI, confidence interval; MCS, Mental Component Summary Score; PCS, Physical Component Summary Score.

MCS/PCS and All-Cause Mortality by Race/Ethnicity

Associations between MCS and PCS and all-cause mortality stratified by ethnicity is shown in Table 6. Among NHW women, compared to cases in PCS T3, those in PCS T1 were twice as likely to die from any cause (HR: 2.13, 95% CI: 1.10, 4.12). The number of events was low in the Hispanic population, hence 95% CI were wide. Hispanics in PCS T1 had a four-fold increased risk of dying due to any cause compared to Hispanics in PCS T3 (HR: 4.05, 95% CI: 0.82, 20.05, but this association was not statistically significant. All associations between MCS and all-cause mortality we close to the null value and not significant when stratified by race/ethnicity.

HRQOL Subscales and All-Cause Mortality

Table 7 displays results from associations between HRQOL subscales and all-cause mortality. Compared to cases in T3, cases in T1 or T2 had an increased risk of death

Table 6. Associations between HRQOL SF-36 Mental & Physical Component Summary Score Tertiles and All-Cause Mortality by Race/Ethnicity (*N* = 351)

	Non-Hispanic White (*n* = 273)		
HRQOL Component Summary Scores[a]	# of Deaths (Total)[b]	HR (95% CI)	*P* Trend
MCS[c]			0.8449
T1 (≤ 45.12)	28 (85)	1.06 (0.58, 1.92)	
T2 (>45.12 & ≤54.40)	29 (90)	1.12 (0.64, 1.95)	
T3 (>54.40)	26 (98)	1.00 (ref)	
PCS[d]			*0.0151*
T1 (≤ 44.75)	47 (90)	**2.13 (1.10, 4.12)**	
T2 (>44.75 & ≤54.39)	22 (90)	1.29 (0.64, 2.58)	
T3 (>54.39)	14 (93)	1.00 (ref)	
	Hispanic (*n* = 78)		
HRQOL Component Summary Scores[a]	# of Deaths (Total)[b]	HR (95% CI)	*P* Trend
MCS[c]			0.7299
T1 (≤ 45.12)	8 (32)	0.89 (0.12, 6.76)	
T2 (>45.12 & ≤54.40)	6 (27)	0.47 (0.05, 4.42)	
T3 (>54.40)	2 (19)	1.00 (ref)	
PCS[d]			0.0661
T1 (≤ 44.75)	8 (27)	4.05 (0.82, 20.05)	
T2 (>44.75 & ≤54.39)	5 (27)	1.06 (0.21, 5.41)	
T3 (>54.39)	3 (24)	1.00 (ref)	

[a] Data collected at 36-month HRQOL follow-up assessment.

[b] Frequency of # of events and total number within the category.

[c] **MCS Model** adjusted for age, marital status, tumor stage, treatment type, comorbidities, current lymphedema, perceived pessimism, number of types of confidants, fear of recurrence, bodily pain, and perceived general health.

[d] **PCS Model** adjusted for age, marital status, tumor stage, treatment type, comorbidities, current lymphedema, perceived pessimism, number of types of confidants, and fear of recurrence.

Abbreviations: HRQOL, Health-Related Quality of Life; HR, hazard ratio; CI, confidence interval; MCS, Mental Component Summary Score; PCS, Physical Component Summary Score.

due to any cause for the following MSC subscales: social functioning (T1, HR: 2.36, 95% CI: 1.51, 3.69), role emotional (T1, HR: 1.94, 95% CI: 1.25, 3.00), role emotional (T1, HR: 1.94, 95% CI: 1.25, 3.00), and vitality (T1, HR: 2.16, 95% CI: 1.25, 3.72; T2, HR:

2.11, 95% CI: 1.22, 3.65). Similarly, risk was increased among the following PCS subscales: physical functioning (T1, HR: 4.55, 95% CI: 2.52, 8.19; T2, HR: 2.11, 95% CI: 1.12, 3.96), role physical (T1, HR: 2.87, 95% CI: 1.75, 4.69; T2, HR: 2.34, 95% CI: 1.36, 4.04), bodily pain (T1, HR: 2.18, 95% CI: 1.39, 3.43), and general health (T1, HR: 1.63, 95% CI: 1.03, 2.59), compared to cases in T3. Additional adjustments in Model 2 attenuated results for social functioning (T1, HR: 1.96, 95% CI: 1.23, 3.11), vitality (T1, HR: 2.00, 95% CI: 1.15, 3.49; T2, HR: 1.92, 95% CI: 1.10, 3.36), physical functioning (T1, HR: 2.65, 95% CI: 1.43, 4.92), role physical (T1, HR: 1.95, 95% CI: 1.17, 3.26; T2, HR: 1.97, 95% CI: 1.13, 3.44), and bodily pain (T1, HR: 1.74, 95% CI: 1.09, 2.77), compared to cases in T3. When adjusted for additional HRQOL characteristics (Model 3), the increased risk of dying from any cause remained significant for the following subscales: vitality (T2, HR: 1.98, 95% CI: 1.12, 3.50) physical functioning (T1, HR: 2.58, 95% CI: 1.38, 4.81), role physical (T1, HR: 1.94, 95% CI: 1.15, 3.25; T2, HR: 1.87, 95% CI: 1.06, 3.30) , and bodily pain (T1, HR: 1.87, 95% CI: 1.15, 3.05).

Associations between HRQOL and Breast Cancer-Specific Mortality

MCS/PCS and Breast Cancer-Specific Mortality

Associations between MCS/PCS and breast cancer-specific mortality are presented in Table 8. Compared to cases with high MCS or PCS scores, crude associations among cases with low MCS scores (HR: 1.40, 95% CI: 0.94, 2.09) or low PCS (HR: 1.09, 95% CI: 0.51, 2.36), were not statistically significant when comparing cases with high MCS or PCS scores, respectively. However, when adjusted for baseline lifestyle and clinical characteristics, associations between PCS and breast cancer-specific

Table 7. Associations between HRQOL SF-36 Subscale Scores and All-Cause Mortality (*N* = 351)

	Model 1[c]			Model 2[d]			Model 3[e]		
Subscale Scores[a]	Deaths (Total)[b]	HR (95% CI)	*P* Trend	Deaths (Total)[b]	HR (95% CI)	*P* Trend	Deaths (Total)[b]	HR (95% CI)	*P* Trend
Social Functioning			*0.0002*			*0.0046*			0.0593
T1 (≤ 40.86)	43 (98)	**2.36 (1.51, 3.69)**		43 (98)	**1.96 (1.23, 3.11)**		43 (98)	1.65 (0.98, 2.79)	
T2 (>40.86 & ≤51.71)	21 (87)	1.18 (0.69, 2.03)		21 (87)	1.35 (0.77, 2.35)		21 (87)	1.32 (0.75, 2.31)	
T3 (>51.71)	35 (166)	1.00 (ref)		35 (166)	1.00 (ref)		35 (166)	1.00 (ref)	
Role Emotional			*0.0030*			0.0567			0.3318
T1 (≤ 34.28)	42 (113)	**1.94 (1.25, 3.00)**		42 (113)	1.55 (0.99, 2.44)		42 (113)	1.27 (0.78, 2.08)	
T2 (>34.28 & ≤44.81)	18 (61)	1.40 (0.80, 2.44)		18 (61)	1.28 (0.73, 2.25)		18 (61)	1.18 (0.67, 2.11)	
T3 (>44.81)	39 (177)	1.00 (ref)		39 (177)	1.00 (ref)		39 (177)	1.00 (ref)	
Vitality			*0.0076*			*0.0201*			0.1627
T1 (≤ 44.33)	41 (121)	**2.16 (1.25, 3.72)**		41 (121)	**2.00 (1.15, 3.49)**		41 (121)	1.61 (0.88, 2.96)	
T2 (>44.33 & ≤53.79)	39 (121)	**2.11 (1.22, 3.65)**		39 (121)	**1.92 (1.10, 3.36)**		39 (121)	**1.98 (1.12, 3.50)**	
T3 (>53.79)	19 (109)	1.00 (ref)		19 (109)	1.00 (ref)		19 (109)	1.00 (ref)	
Mental Health			0.0982			0.0543			0.2250
T1 (≤ 43.63)	35 (108)	1.51 (0.93, 2.46)		35 (108)	1.64 (0.99, 2.71)		35 (108)	1.41 (0.81, 2.47)	
T2 (>43.63 & ≤52.72)	34 (114)	1.32 (0.81, 2.16)		34 (114)	1.37 (0.83, 2.25)		34 (114)	1.34 (0.80, 2.25)	
T3 (>52.72)	30 (129)	1.00 (ref)		30 (129)	1.00 (ref)		30 (129)	1.00 (ref)	
Physical Functioning			*<0.0001*			*0.0012*			*0.0023*
T1 (≤ 43.17)	54 (118)	**4.55 (2.52, 8.19)**		54 (118)	**2.65 (1.43, 4.92)**		54 (118)	**2.58 (1.38, 4.81)**	
T2 (>43.17 & ≤52.49)	31 (123)	**2.11 (1.12, 3.96)**		31 (123)	1.73 (0.91, 3.28)		31 (123)	1.82 (0.96, 3.46)	
T3 (>52.49)	14 (110)	1.00 (ref)		14 (110)	1.00 (ref)		14 (110)	1.00 (ref)	
Role Physical			*<0.0001*			*0.0131*			*0.0146*
T1 (≤ 35.03)	47 (116)	**2.87 (1.75, 4.69)**		47 (116)	**1.95 (1.17, 3.26)**		47 (116)	**1.94 (1.15, 3.25)**	
T2 (>35.03 & ≤49.18)	28 (88)	**2.34 (1.36, 4.04)**		28 (88)	**1.97 (1.13, 3.44)**		28 (88)	**1.87 (1.06, 3.30)**	
T3 (>49.18)	24 (147)	1.00 (ref)		24 (147)	1.00 (ref)		24 (147)	1.00 (ref)	

	Model 1[c]			Model 2[d]			Model 3[e]		
Subscale Scores[a]	Deaths (Total)[b]	HR (95% CI)	*P* Trend	Deaths (Total)[b]	HR (95% CI)	*P* Trend	Deaths (Total)[b]	HR (95% CI)	*P* Trend
Bodily Pain			*0.0007*			*0.0199*			*0.0122*
T1 (≤ 46.05)	44 (106)	**2.18 (1.39, 3.43)**		44 (106)	**1.74 (1.09, 2.77)**		44 (106)	**1.87 (1.15, 3.05)**	
T2 (>46.05 & ≤54.19)	22 (81)	1.38 (0.80, 2.36)		22 (81)	1.16 (0.68, 2.01)		22 (81)	1.10 (0.63, 1.91)	
T3 (>54.19)	33 (164)	1.00 (ref)		33 (164)	1.00 (ref)		33 (164)	1.00 (ref)	
General Health			*0.0327*			0.1959			0.3072
T1 (≤ 46.28)	45 (123)	**1.63 (1.03, 2.59)**		45 (123)	1.33 (0.82, 2.16)		45 (123)	1.25 (0.76, 2.05)	
T2 (>46.28 & ≤54.64)	24 (104)	0.95 (0.55, 1.62)		24 (104)	0.84 (0.48, 1.45)		24 (104)	0.79 (0.45, 1.38)	
T3 (>54.64)	30 (124)	1.00 (ref)		30 (124)	1.00 (ref)		30 (124)	1.00 (ref)	

[a] Data collected at 36-month HRQOL follow-up assessment.

[b] Frequency of # of events and total number within the category.

[c] **Model 1:** crude.

[d] **Model 2:** adjusted for baseline lifestyle and clinical characteristics. Mental-related: age, race/ethnicity, marital status, tumor stage, treatment type, and comorbidities; Physical-related: age, race/ethnicity, marital status, tumor stage, treatment type, and comorbidities.

[e] **Model 3:** adjusted for additional HRQOL characteristics in addition to Model 1. Mental-related: current lymphedema, perceived pessimism, number of types of confidants, bodily pain, and perceived general health. Physical-related: current lymphedema, perceived pessimism, number of types of confidants, fear of recurrence.

Mortality were significantly increased (HR: 1.71, 95% CI: 1.10, 2.63), as well as the association adjusted for additional HRQOL characteristics (HR: 1.65, 95% CI: 1.06, 2.58).

Table 8. Associations between HRQOL SF-36 Mental & Physical Component Summary Score Tertiles and Breast Cancer-Specific Mortality (*N* = 351)

	Model 1[c]		
HRQOL Component Summary Scores[a]	# of Deaths (Total)[b]	HR (95% CI)	*P*
MCS			0.2238
Low (≤ 50.70)	14 (176)	1.40 (0.94, 2.09)	
High (>50.70)	12 (175)	1.00 (ref)	
PCS			0.8239
Low (≤ 50.28)	13 (176)	1.09 (0.51, 2.36)	
High (>50.28)	13 (175)	1.00 (ref)	
	Model 2[d]		
HRQOL Component Summary Scores[a]	# of Deaths (Total)[b]	HR (95% CI)	*P*
MCS			0.1139
Low (≤ 50.70)	14 (176)	1.39 (0.93, 2.09)	
High (>50.70)	12 (175)	1.00 (ref)	
PCS			*0.0161*
Low (≤ 50.28)	13 (176)	**1.71 (1.10, 2.63)**	
High (>50.28)	13 (175)	1.00 (ref)	
	Model 3[e]		
HRQOL Component Summary Scores[a]	# of Deaths (Total)[b]	HR (95% CI)	*P*
MCS			0.4284
Low (≤ 50.70)	14 (176)	1.24 (0.81, 1.91)	
High (>50.70)	12 (175)	1.00 (ref)	
PCS			*0.0283*
Low (≤ 50.28)	13 (176)	**1.65 (1.06, 2.58)**	
High (>50.28)	13 (175)	1.00 (ref)	

a: Data collected at 36-month HRQOL follow-up assessment.

b: frequency of # of events and total number within the category.

Model 1: crude.

Model 2: adjusted for baseline lifestyle and clinical characteristics. MCS: age, race/ethnicity, marital status, tumor stage, treatment type; PCS: age, race/ethnicity, marital status, tumor stage, treatment type, and comorbidities.

Model 3: adjusted for additional HRQOL characteristics in addition to Model 1. MCS: current lymphedema, perceived pessimism, number of types of confidants, bodily pain, and perceived general health. PCS: current lymphedema perceived pessimism, number of types of confidants, fear of recurrence;
Abbreviations: HRQOL, Health-Related Quality of Life; HR, hazard ratio; CI, confidence interval; MCS, Mental Component Summary Score; PCS, Physical Component Summary Score.

MCS/PCS and Breast Cancer-Specific Mortality by Race/Ethnicity

The previous associations were stratified by ethnicity and is presented in Table 9. Among NHW women, cases in PCS T1 had a two-fold increased risk of dying of breast cancer compared to cases in PCS T3 (HR: 1.93, 95% CI: 1.16, 3.23). Hispanic women with low MCS scores had a four-fold increased risk of breast cancer-specific mortality compared to Hispanic women with high MCS scores (HR: 4.11, 95% CI: 0.80, 21.04), though the association was not statistically significant due to the small number of events.

Table 9. Associations between HRQOL SF-36 Mental & Physical Component Summary Score Tertiles and Breast Cancer-Specific Mortality by Race/Ethnicity (*N* = 351)

	Non-Hispanic White (*n* = 273)		
HRQOL Component Summary Scores[a]	# of Deaths (Total)[b]	HR (95% CI)	*P*-value
MCS[c]			0.6568
Low (≤ 50.70)	11 (131)	1.11 (0.70, 1.77)	
High (>50.70)	10 (142)	1.00 (ref)	
PCS[d]			*0.0115*
Low (≤ 50.28)	11 (137)	**1.93 (1.16, 3.23)**	
High (>50.28)	10 (136)	1.00 (ref)	
	Hispanic (*n* = 78)		
HRQOL Component Summary Scores[a]	# of Deaths (Total)[b]	HR (95% CI)	*P*-value
	Hispanic (*n* = 78)		

HRQOL Component Summary Scores[a]	# of Deaths (Total)[b]	HR (95% CI)	*P*-value
MCS[c]			0.0900
Low (≤ 50.70)	3 (45)	4.11 (0.80, 21.04)	
High (>50.70)	2 (33)	1.00 (ref)	
PCS[d]			0.5070
Low (≤ 50.28)	2 (39)	1.51 (0.45, 5.05)	
High (>50.28)	3 (39)	1.00 (ref)	

[a.] Data collected at 36-month HRQOL follow-up assessment.

[b.] Frequency of # of events and total number within the category.

[c.] **MCS Model** adjusted for age, marital status, tumor stage, treatment type, comorbidities, current lymphedema, perceived pessimism, number of types of confidants, fear of recurrence, bodily pain, and perceived general health.

[d.] **PCS Model** adjusted for age, marital status, tumor stage, treatment type, comorbidities, current lymphedema, perceived pessimism, number of types of confidants, and fear of recurrence.

Abbreviations: HRQOL, Health-Related Quality of Life; HR, hazard ratio; CI, confidence interval; MCS, Mental Component Summary Score; PCS, Physical Component Summary Score.

HRQOL Subscales and Breast Cancer-Specific Mortality

Associations between each subscale and breast cancer-specific mortality are portrayed in Table 10. There were no significant associations. However, the crude risk of dying was somewhat stronger for certain physical subscales, such as cases with low physical functioning scores (HR: 1.56, 95% CI: 0.70, 3.51) compared to cases with high physical functioning scores.

Associations between HRQOL and Non-Cancer Mortality

MCS/PCS and Non-cancer Mortality

Table 11 presents associations between MCS and PCS component summary scores and risk of death due to non-cancer causes. Similar associations between HRQOL component summary scores and all-cause mortality, there were significant increased risks

Table 10. Associations between HRQOL SF-36 Subscale Scores and Breast Cancer-Specific Mortality (*N* = 351)

	Model 1[c]			Model 2[d]			Model 3[e]		
Subscale Scores[a]	Deaths (Total)[b]	HR (95% CI)	*P*	Deaths (Total)[b]	HR (95% CI)	*P*	Deaths (Total)[b]	HR (95% CI)	*P*
Social Functioning			0.7753			0.9530			0.7044
Low (≤ 57.13)	14 (185)	1.12 (0.52, 2.42)		14 (185)	1.03 (0.46, 2.31)		14 (185)	0.84 (0.35, 2.04)	
High (>57.13)	12 (166)	1.00 (ref)		12 (166)	1.00 (ref)		12 (166)	1.00 (ref)	
Role Emotional			0.5111			0.7636			0.9997
Low (≤ 55.34)	14 (174)	1.30 (0.60, 2.80)		14 (174)	1.13 (0.51, 2.48)		14 (174)	1.00 (0.43, 2.32)	
High (>55.34)	12 (177)	1.00 (ref)		12 (177)	1.00 (ref)		12 (177)	1.00 (ref)	
Vitality			0.7682			0.8143			0.9683
Low (≤ 51.42)	14 (183)	1.12 (0.52, 2.43)		14 (183)	1.10 (0.49, 2.47)		14 (183)	0.98 (0.39, 2.45)	
High (>51.42)	12 (168)	1.00 (ref)		12 (168)	1.00 (ref)		12 (168)	1.00 (ref)	
Mental Health			0.6757			0.5060			0.7049
Low (≤ 52.71)	14 (177)	1.18 (0.55, 2.55)		14 (177)	1.31 (0.59, 2.90)		14 (177)	1.18 (0.50, 2.79)	
High (>52.71)	12 (174)	1.00 (ref)		12 (174)	1.00 (ref)		12 (174)	1.00 (ref)	
Physical Functioning			0.7614			0.6906			0.7223
Low (≤ 50.15)	12 (166)	1.13 (0.52, 2.44)		12 (166)	1.18 (0.52, 2.66)		12 (166)	1.16 (0.51, 2.63)	
High (>50.15)	14 (185)	1.00 (ref)		14 (185)	1.00 (ref)		14 (185)	1.00 (ref)	
Role Physical			0.2802			0.5935			0.6681
Low (≤ 56.24)	17 (204)	1.56 (0.70, 3.51)		17 (204)	1.26 (0.54, 2.93)		17 (204)	1.21 (0.51, 2.88)	
High (>56.24)	9 (147)	1.00 (ref)		9 (147)	1.00 (ref)		9 (147)	1.00 (ref)	
Bodily Pain			0.7762			0.9850			0.9208
Low (≤ 54.18)	14 (184)	1.12 (0.52, 2.42)		14 (184)	1.01 (0.46, 2.23)		14 (184)	0.96 (0.43, 2.15)	
High (>54.18)	12 (167)	1.00 (ref)		12 (167)	1.00 (ref)		12 (167)	1.00 (ref)	
General Health			0.8683			0.9954			0.6920
Low (≤ 52.29)	13 (188)	0.94 (0.43, 2.02)		13 (188)	1.00 (0.45, 2.23)		13 (188)	0.84 (0.25, 2.01)	
High (>52.29)	13 (163)	1.00 (ref)		13 (163)	1.00 (ref)		13 (163)	1.00 (ref)	

	Model 1[c]			Model 2[d]			Model 3[e]		
Subscale Scores[a]	Deaths (Total)[b]	HR (95% CI)	*P*	Deaths (Total)[b]	HR (95% CI)	*P*	Deaths (Total)[b]	HR (95% CI)	*P*

[a] Data collected at 36-month HRQOL follow-up assessment.

[b] Frequency of # of events and total number within the category.

[c] **Model 1:** crude.

[d] **Model 2:** adjusted for baseline lifestyle and clinical characteristics. Mental-related: age, race/ethnicity, marital status, tumor stage, treatment type, and comorbidities; Physical-related: age, race/ethnicity, marital status, tumor stage, treatment type, and comorbidities.

[e] **Model 3:** adjusted for additional HRQOL characteristics in addition to Model 1. Mental-related: current lymphedema, perceived pessimism, number of types of confidants, bodily pain, and perceived general health. Physical-related: current lymphedema, perceived pessimism, number of types of confidants, fear of recurrence.

of cases in PCS T1 compared to cases in PCS T3. Participants had a nearly six-fold increased risk of dying from non-cancer causes if they were in PCS T1 compared to PCS T3 (HR: 5.63, 95% CI: 2.74, 11.55; p-trend=<0.0001). This association was attenuated by 56.48% when adjusted for baseline and clinical characteristics (Model 2) (HR: 2.45, 95% CI: 1.14, 5.26; p-trend=0.0025), and similar (percent change: 54.35%) when adjusted for additional HRQOL characteristics (HR: 2.57, 95% CI: 1.18, 5.61; p-trend=0.0023). No significant associations were discerned for MCS scores and non-cancer mortality.

Table 11. Associations between HRQOL SF-36 Mental & Physical Component Summary Score Tertiles and Non-Cancer Mortality (*N* = 351)

	Model 1[c]		
HRQOL Component Summary Scores[a]	# of Deaths (Total)[b]	HR (95% CI)	*P* Trend
MCS			0.2502
T1 (≤ 45.12)	23 (117)	1.45 (0.78, 2.72)	
T2 (>45.12 & ≤54.40)	24 (117)	1.41 (0.76, 2.64)	
T3 (>54.40)	17 (117)	1.00 (ref)	
PCS			*<0.0001*
T1 (≤ 44.75)	43 (117)	**5.63 (2.74, 11.55)**	
T2 (>44.75 & ≤54.39)	12 (117)	1.41 (0.59, 3.35)	
T3 (>54.39)	9 (117)	1.00 (ref)	
	Model 2[d]		
HRQOL Component Summary Scores[a]	# of Deaths (Total)[b]	HR (95% CI)	*P* Trend
MCS			0.1426
T1 (≤ 45.12)	23 (117)	1.63 (0.84, 3.14)	
T2 (>45.12 & ≤54.40)	24 (117)	1.40 (0.74, 2.64)	
T3 (>54.40)	17 (117)	1.00 (ref)	
PCS			*0.0025*
T1 (≤ 44.75)	43 (117)	**2.45 (1.14, 5.27)**	
T2 (>44.75 & ≤54.39)	12 (117)	0.86 (0.35, 2.08)	
T3 (>54.39)	9 (117)	1.00 (ref)	
	Model 3[e]		

HRQOL Component Summary Scores[a]	# of Deaths (Total)[b]	HR (95% CI)	*P* Trend
MCS			0.3187
T1 (≤ 45.12)	23 (117)	1.42 (0.70, 2.87)	
T2 (>45.12 & ≤54.40)	24 (117)	1.49 (0.77, 2.87)	
T3 (>54.40)	17 (117)	1.00 (ref)	
PCS			*0.0023*
T1 (≤ 44.75)	43 (117)	**2.57 (1.18, 5.61)**	
T2 (>44.75 & ≤54.39)	12 (117)	0.94 (0.38, 2.32)	
T3 (>54.39)	9 (117)	1.00 (ref)	

[a.] Data collected at 36-month HRQOL follow-up assessment.

[b.] frequency of # of events and total number within the category.

[c.] **Model 1:** crude.

[d.] **Model 2:** adjusted for baseline lifestyle and clinical characteristics. MCS: age, race/ethnicity, marital status, tumor stage, treatment type; PCS: age, race/ethnicity, marital status, tumor stage, treatment type, and comorbidities.

[e.] **Model 3:** adjusted for additional HRQOL characteristics in addition to Model 1. MCS: current lymphedema, perceived pessimism, number of types of confidants, bodily pain, and perceived general health. PCS: current lymphedema, perceived pessimism, number of types of confidants, fear of recurrence;

Abbreviations: HRQOL, Health-Related Quality of Life; HR, hazard ratio; CI, confidence interval; MCS, Mental Component Summary Score; PCS, Physical Component Summary Score.

MCS/PCS and Non-Cancer Mortality by Race/Ethnicity

Stratification of the previous associations by race/ethnicity is presented in Table 12. There were no significant associations, partly due to a low number of events in NHW and Hispanic women. Even though they were not significant, results were suggestive of increased risk of dying due to non-cancer causes for both NHW (HR: 2.08, 95% CI: 0.84, 5.16) and Hispanic (HR: 2.62, 95% CI: 0.38, 18.30) women in PCS T1 vs. PCS T3.

HRQOL Subscales and Non-Cancer Mortality

Associations between HRQOL subscale scores and non-cancer mortality is presented in Table 13. A significant increased risk of death due to non-cancer causes

Table 12. Associations between HRQOL SF-36 Mental & Physical Component Summary Score Tertiles and Non-Cancer Mortality by Race/Ethnicity (*N* = 351)

	Non-Hispanic White (*n* = 273)		
HRQOL Component Summary Scores[a]	# of Deaths (Total)[b]	HR (95% CI)	*P* Trend
MCS[c]			0.6215
T1 (≤ 45.12)	18 (85)	1.20 (0.56, 2.54)	
T2 (>45.12 & ≤54.40)	21 (90)	1.31 (0.64, 2.65)	
T3 (>54.40)	16 (98)	1.00 (ref)	
PCS[d]			*0.0116*
T1 (≤ 44.75)	38 (90)	2.08 (0.84, 5.16)	
T2 (>44.75 & ≤54.39)	10 (90)	0.69 (0.24, 1.96)	
T3 (>54.39)	7 (93)	1.00 (ref)	
	Hispanic (*n* = 78)		
HRQOL Component Summary Scores[a]	# of Deaths (Total)[b]	HR (95% CI)	*P* Trend
MCS[c]			0.9699
T1 (≤ 45.12)	5 (32)	1.19 (0.07, 19.20)	
T2 (>45.12 & ≤54.40)	3 (27)	1.33 (0.08, 22.14)	
T3 (>54.40)	1 (19)	1.00 (ref)	
PCS[d]			0.2988
T1 (≤ 44.75)	5 (27)	2.62 (0.38, 18.30)	
T2 (>44.75 & ≤54.39)	2 (27)	0.45 (0.04, 4.59)	
T3 (>54.39)	2 (24)	1.00 (ref)	

[a] Data collected at 36-month HRQOL follow-up assessment.

[b] frequency of # of events and total number within the category.

[c] **MCS Model** adjusted for age, marital status, tumor stage, treatment type, comorbidities, current lymphedema, perceived optimism, number of types of confidants, fear of recurrence, bodily pain, and perceived general health.

[d] **PCS Model** adjusted for age, marital status, tumor stage, treatment type, comorbidities, current lymphedema, perceived optimism, number of types of confidants, and fear of recurrence.

Abbreviations: HRQOL, Health-Related Quality of Life; HR, hazard ratio; CI, confidence interval; MCS, Mental Component Summary Score; PCS, Physical Component Summary Score.

was observed for seven subscales. Specifically, cases in the physical functioning T1, had a 9-fold increased risk (T1, HR: 9.11, 95% CI: 3.58, 23.15) compared to cases in T3. Cases in T1 for social functioning (T1, HR: 3.27, 95% CI: 1.85, 5.77),

Table 13. Associations between HRQOL SF-36 Subscale Scores and Non-Cancer Mortality (*N* = 351)

	Model 1[c]			Model 2[d]			Model 3[e]		
Subscale Scores[a]	Deaths (Total)[b]	HR (95% CI)	*P* Trend	Deaths (Total)[b]	HR (95% CI)	*P* Trend	Deaths (Total)[b]	HR (95% CI)	*P* Trend
Social Functioning			*<0.0001*			0.0010			*0.0037*
T1 (≤ 40.86)	32 (98)	**3.27 (1.85, 5.77)**		32 (98)	**2.66 (1.48, 4.79)**		32 (98)	**2.62 (1.36, 5.05)**	
T2 (>40.86 & ≤51.71)	13 (87)	1.35 (0.67, 2.74)		13 (87)	1.64 (0.79, 3.38)		13 (87)	1.84 (0.88, 3.85)	
T3 (>51.71)	19 (166)	1.00 (ref)		19 (166)	1.00 (ref)		19 (166)	1.00 (ref)	
Role Emotional			*0.0044*			0.0802			0.1935
T1 (≤ 34.28)	29 (113)	**2.20 (1.28, 3.78)**		29 (113)	1.67 (0.94, 2.95)		29 (113)	1.50 (0.81, 2.78)	
T2 (>34.28 & ≤44.81)	11 (61)	1.39 (0.68, 2.84)		11 (61)	1.32 (0.64, 2.72)		11 (61)	1.31 (0.62, 2.74)	
T3 (>44.81)	24 (177)	1.00 (ref)		24 (177)	1.00 (ref)		24 (177)	1.00 (ref)	
Vitality			*0.0041*			*0.0098*			*0.0427*
T1 (≤ 44.33)	31 (121)	**2.61 (1.34, 5.09)**		31 (121)	**2.41 (1.22, 4.77)**		31 (121)	**2.18 (1.04, 4.58)**	
T2 (>44.33 & ≤53.79)	21 (121)	1.84 (0.90, 3.74)		21 (121)	1.70 (0.82, 3.49)		21 (121)	1.81 (0.86, 3.80)	
T3 (>53.79)	12 (109)	1.00 (ref)		12 (109)	1.00 (ref)		12 (109)	1.00 (ref)	
Mental Health			0.0990			0.0631			0.1205
T1 (≤ 43.63)	24 (108)	1.66 (0.91, 3.03)		24 (108)	1.81 (0.97, 3.38)		24 (108)	1.73 (0.86, 3.46)	
T2 (>43.63 & ≤52.72)	21 (114)	1.30 (0.70, 2.43)		21 (114)	1.29 (0.69, 2.42)		21 (114)	1.41 (0.73, 2.74)	
T3 (>52.72)	19 (129)	1.00 (ref)		19 (129)	1.00 (ref)		19 (129)	1.00 (ref)	
Physical Functioning			*<0.0001*			*0.0019*			*0.0019*
T1 (≤ 43.17)	38 (118)	**9.11 (3.58, 23.2)**		38 (118)	**4.36 (1.68, 11.34)**		38 (118)	**4.43 (1.69, 11.7)**	
T2 (>43.17 & ≤52.49)	21 (123)	**3.98 (1.50, 10.6)**		21 (123)	3.16 (1.19, 8.43)		21 (123)	**3.17 (1.17, 8.60)**	
T3 (>52.49)	5 (110)	1.00 (ref)		5 (110)	1.00 (ref)		5 (110)	1.00 (ref)	
Role Physical			*<0.0001*			*0.0031*			*0.0033*
T1 (≤ 35.03)	37 (116)	**3.64 (2.00, 6.64)**		37 (116)	**2.47 (1.33, 4.58)**		37 (116)	**2.51 (1.34, 4.71)**	
T2 (>35.03 & ≤49.18)	12 (88)	1.64 (0.77, 3.50)		12 (88)	1.48 (0.68, 3.23)		12 (88)	1.49 (0.67, 3.29)	
T3 (>49.18)	15 (147)	1.00 (ref)		15 (147)	1.00 (ref)		15 (147)	1.00 (ref)	

	Model 1[c]			Model 2[d]			Model 3[e]		
Subscale Scores[a]	Deaths (Total)[b]	HR (95% CI)	*P* Trend	Deaths (Total)[b]	HR (95% CI)	*P* Trend	Deaths (Total)[b]	HR (95% CI)	*P* Trend
Bodily Pain			*0.0002*			*0.0026*			*0.0014*
T1 (≤ 46.05)	34 (106)	**2.91 (1.66, 5.10)**		34 (106)	**2.33 (1.32, 4.12)**		34 (106)	**2.71 (1.46, 5.03)**	
T2 (>46.05 & ≤54.19)	11 (81)	1.18 (0.56, 2.49)		11 (81)	0.94 (0.44, 1.99)		11 (81)	0.94 (0.44, 2.00)	
T3 (>54.19)	19 (164)	1.00 (ref)		19 (164)	1.00 (ref)		19 (164)	1.00 (ref)	
General Health			*0.0035*			*0.0125*			*0.0146*
T1 (≤ 46.28)	34 (123)	**2.31 (1.27, 4.18)**		34 (123)	**2.01 (1.11, 3.66)**		34 (123)	**2.04 (1.11, 3.76)**	
T2 (>46.28 & ≤54.64)	14 (104)	1.03 (0.50, 2.11)		14 (104)	0.92 (0.45, 1.89)		14 (104)	0.97 (0.47, 2.01)	
T3 (>54.64)	16 (124)	1.00 (ref)		16 (124)	1.00 (ref)		16 (124)	1.00 (ref)	

[a] Data collected at 36-month HRQOL follow-up assessment.

[b] Frequency of # of events and total number within the category.

[c] **Model 1:** crude.

[d] **Model 2:** adjusted for baseline lifestyle and clinical characteristics. Mental-related: age, race/ethnicity, marital status, tumor stage, treatment type, and age, race/ethnicity, comorbidities; Physical-related: marital status, tumor stage, and treatment type.

[e] **Model 3:** adjusted for additional HRQOL characteristics in addition to Model 1. Mental-related: current lymphedema, perceived optimism number of types of confidants, bodily pain, and perceived general health. Physical-related: current lymphedema, perceived optimism, number of types of confidants, fear of recurrence.

role emotional (T1, HR: 2.20, 95% CI: 1.28, 3.78), vitality (T1, HR: 2.61, 95% CI: 1.34, 3.78), role physical (T1, HR: 3.64, 95% CI: 2.00, 6.64), bodily pain (T1, HR: 2.91, 95% CI: 1.66, 5.10), and general health (T1, HR: 2.31, 95% CI: 1.27, 4.18) were at significantly increased risk of dying due to non-cancer causes compared to cases in T3.

When adjusted for baseline lifestyle and clinical characteristics, all of the associations were attenuated for social functioning (T1, HR: 2.66, 95% CI: 1.48, 4.79), vitality (T1, HR: 2.41, 95% CI: 1.22, 4.77), physical functioning (T1, HR: 4.36, 95% CI: 1.68, 11.34), role physical (T1, HR: 2.47, 95% CI: 1.33, 4.58), bodily pain (T1, HR: 2.33, 95% CI: 1.32, 4.12), and general health (T1, HR: 2.01, 95% CI: 1.11, 3.66).

When further adjusted for additional HRQOL characteristics, subscales significant in Model 2 were also significant in Model 3. Specifically, cases in T1 or T2 compared to T3 for physical functioning had nearly 4.5 times the increased risk of dying (T1, HR: 4.43, 95% CI: 1.69, 11.65; T2, HR: 3.17, 95% CI: 1.17, 8.60). Cases in the T1 of all physical subscales (physical functioning, role physical, bodily pain, and general health) had at least a two-fold increased risk of dying compared to cases in T3.

Kaplan-Meier Curves and Survival Rates

Seventeen survival curves were constructed to plot the distribution of survival rates by all-cause, breast cancer-specific, and non-cancer mortality for the entire study population. Additional curves were constructed stratified by race/ethnicity for all-cause and non-cancer mortality only because of sample size concerns. In the total population, the five-year survival rate was 89.4%, and 77.7% for 10-year survival, when considering death due to any cause.

For all-cause mortality, survival curves significantly differed by PCS tertiles (p=<0.0001); however, survival curves did not by MCS tertiles (p=0.4643). The five-year survival rate for PCS and all participants was higher than 75%. When approaching ten years, cases in T1 had approximately a 60% survival rate compared to approximately 90% for cases in T3. Rates continued to decrease for T1 cases, yet remained constant for T2 and T3. Survival rates depicting PCS and non-cancer mortality told a similar story. However, participants in T1 had a much worse survival rate compared to participants in T2 and T3. Curves displaying rates for breast cancer-specific mortality did not reveal any significant differences. Figures 3 and 4 display survival curves for all-cause mortality and MCS/PCS.

When stratifying PCS for all-cause and non-cancer by race/ethnicity, the pattern for differences in PCS by tertiles was weighted by the higher number of NHW cases in relation to Hispanic cases. These curves are displayed in Figures 5, 6, 7, and 8. For all-cause mortality by race/ethnicity, the survival curves significantly differed by PCS tertiles (p=<0.0001), and the same association can be found for non-cancer mortality (p=<0.0001). However, this was not true for Hispanic cases for PCS tertiles and all-cause mortality (p=0.2415) and PCS tertiles and non-cancer mortality (p=0.3032).At about 11 years post-diagnosis, NHW cases in T1 had a 50% survival rate compared to NHW cases in T3 (~90%). For non-cancer outcomes, the survival rates were similar by tertile. The remaining survival curves are presented in the Appendices section (P-Z).

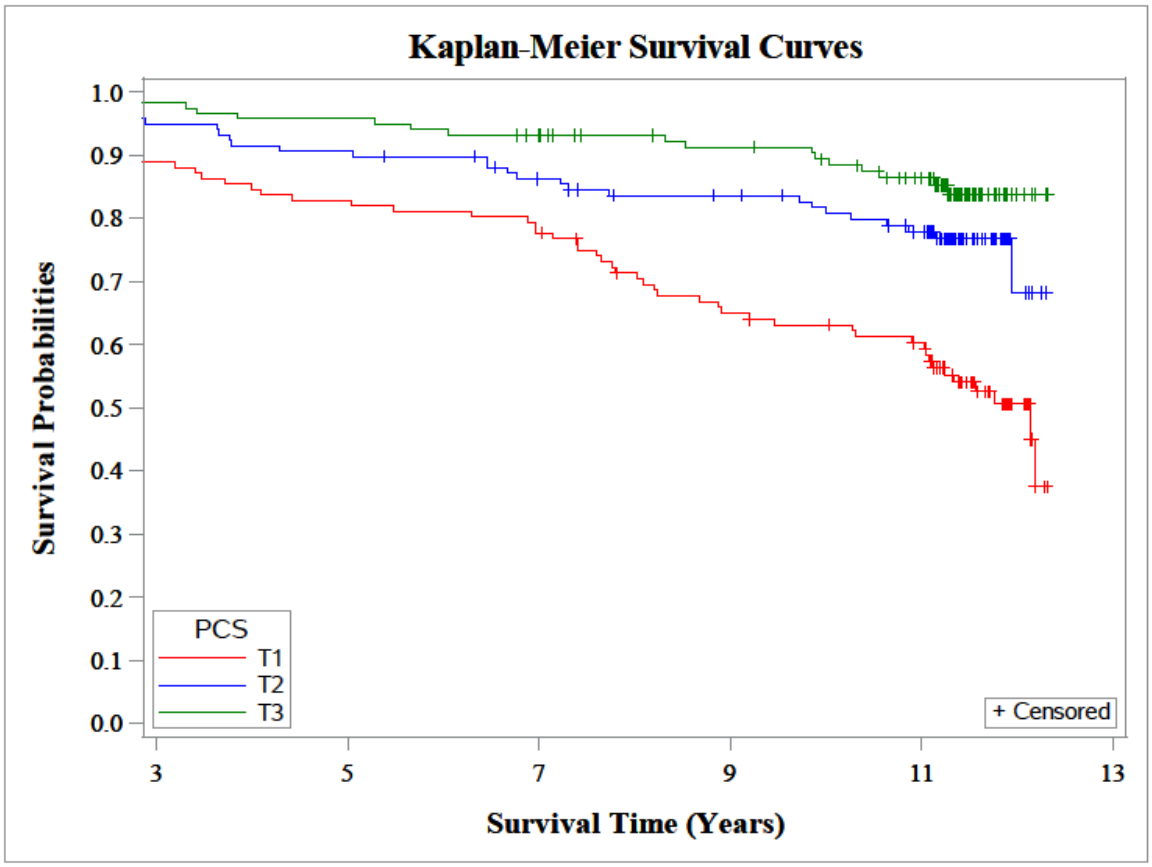


Figure 3. Kaplan-Meier Curves: (All-Cause) Survival Probability Estimates for PCS Tertiles.

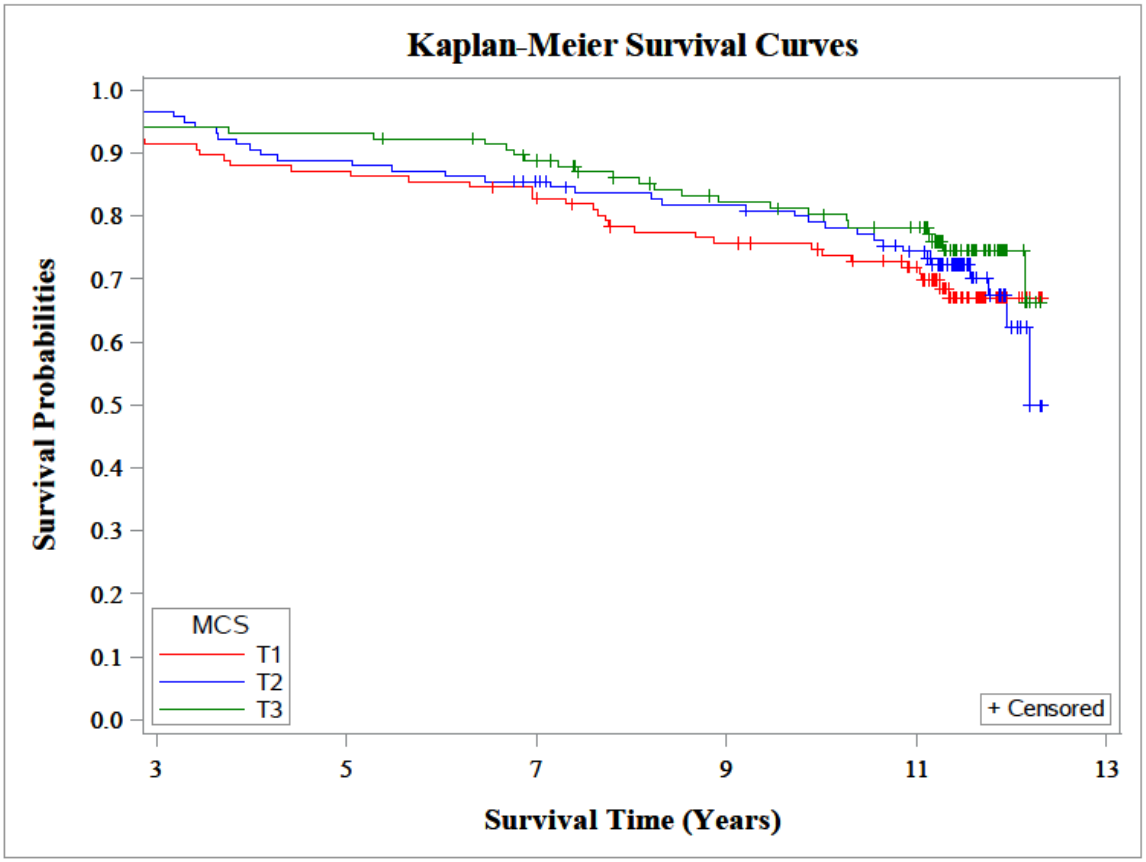


Figure 4. Kaplan-Meier Curves: (All-Cause) Survival Probability Estimates for MCS Tertiles.

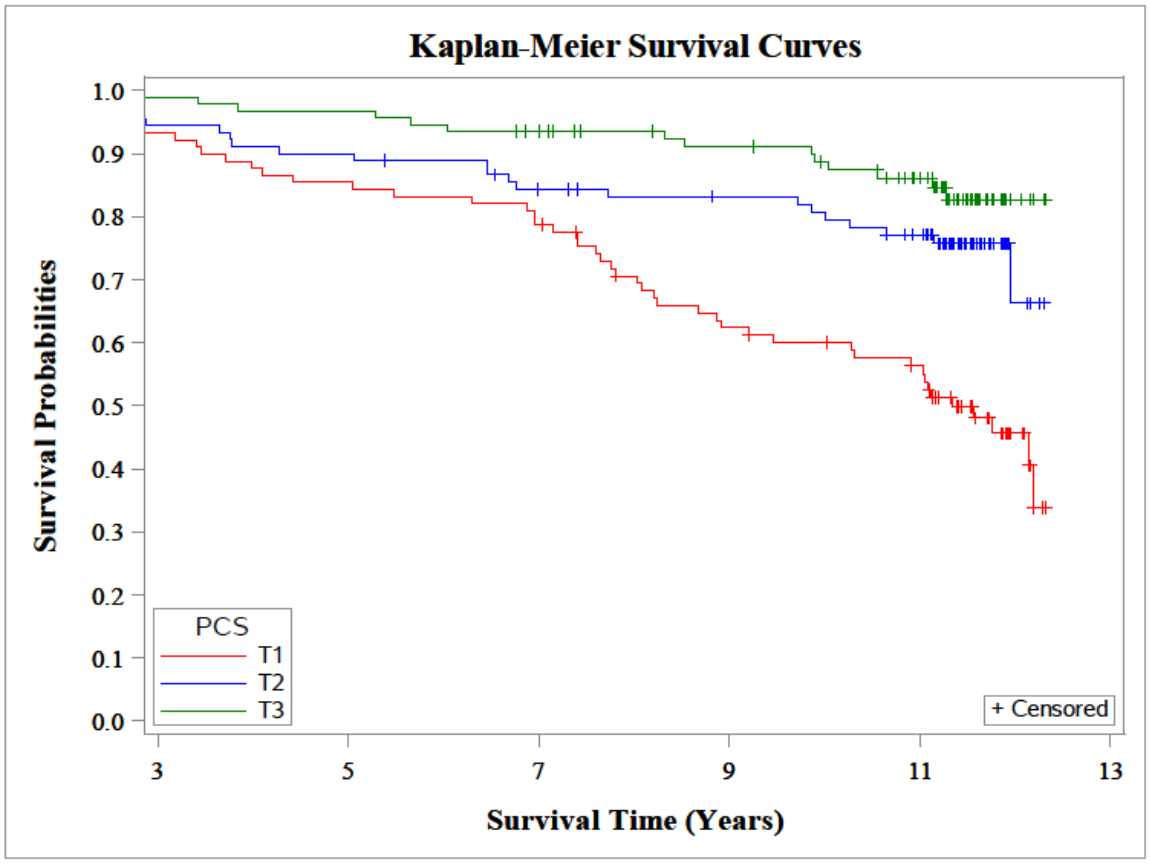


Figure 5. Kaplan-Meier Curves: (All-Cause) Survival Probability Estimates for PCS Tertiles by Race/Ethnicity (NHW Women).

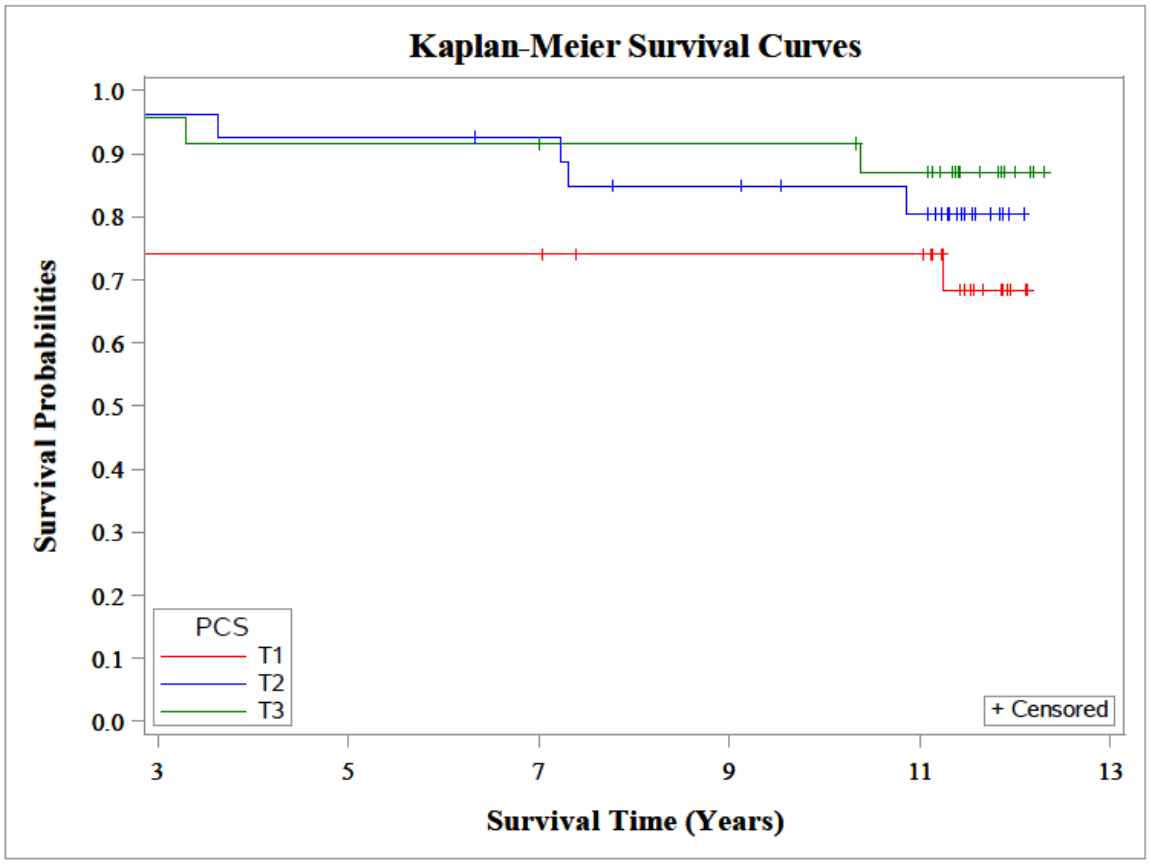


Figure 6. Kaplan-Meier Curves: (All-Cause) Survival Probability Estimates for PCS Tertiles by Race/Ethnicity (Hispanic Women).

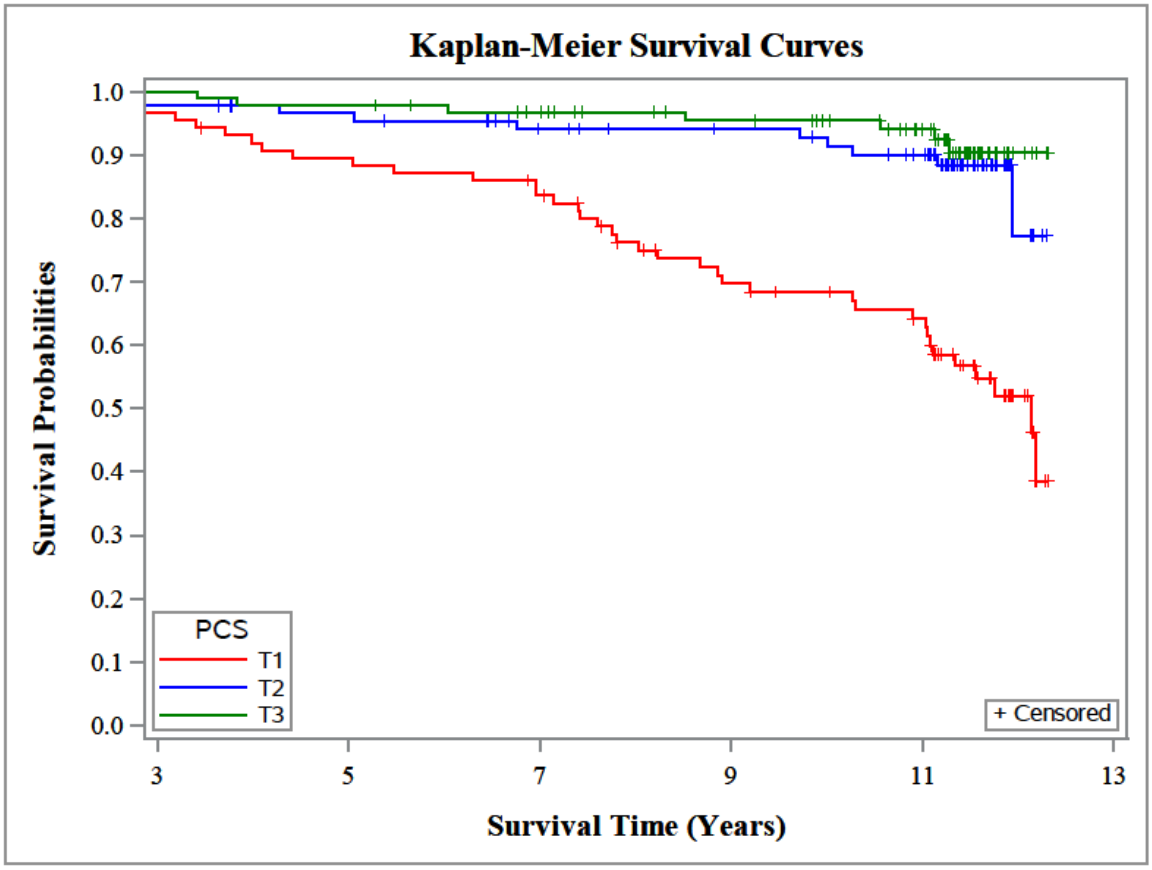


Figure 7. Kaplan-Meier Curves: (Non-Cancer) Survival Probability Estimates for PCS Tertiles by Race/Ethnicity (NHW Women).

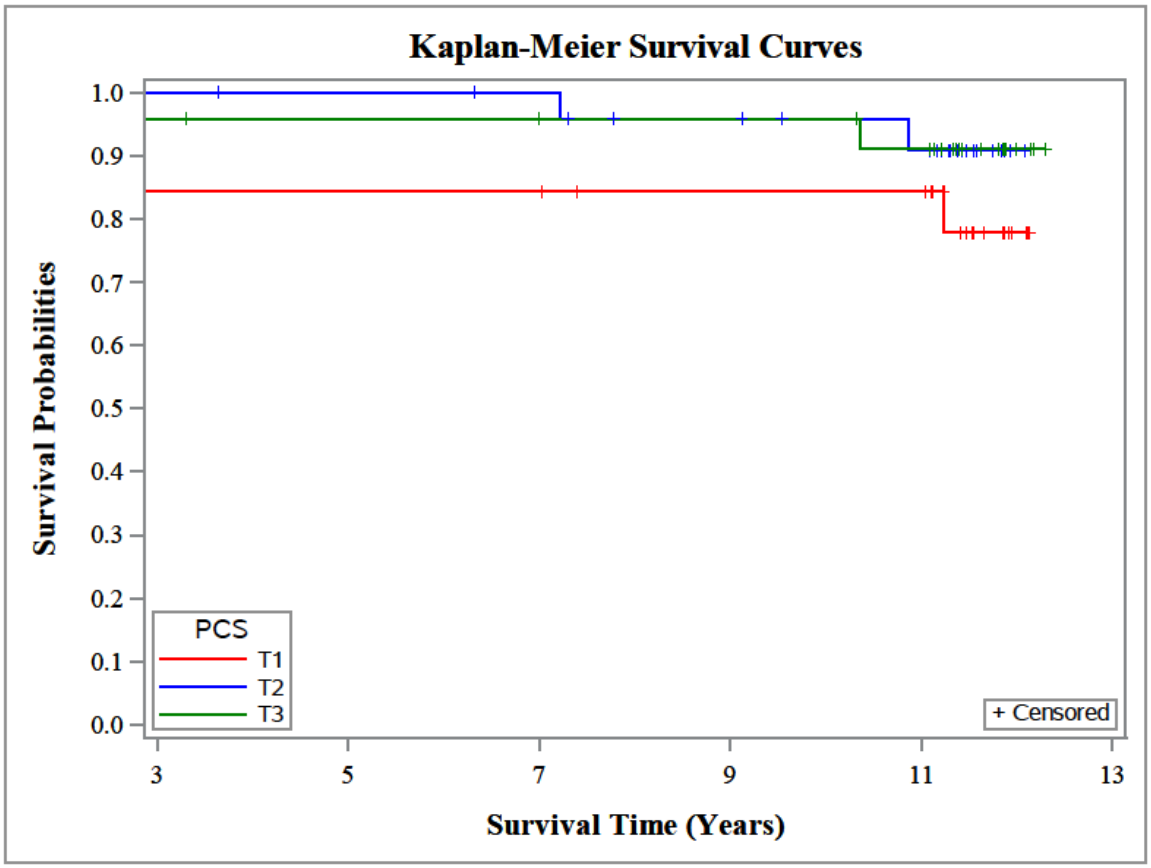


Figure 8. Kaplan-Meier Curves: (Non-Cancer) Survival Probability Estimates for PCS Tertiles by Race/Ethnicity (Hispanic Women).

DISCUSSION

To our knowledge, this is the first study to evaluate physical (PCS) and mental (MCS) component summary scores from the SF-36 instrument as a predictor of breast cancer mortality among NHW and Hispanic women. A few other studies evaluating HRQOL via the SF-36 as a predictor of breast cancer prognosis will be discussed later (87-89).

Results from the present study indicate that the physical-related items of HRQOL among women with invasive breast cancer approximately 3-years post-diagnosis were statistically significantly associated with a decreased risk of all-cause, breast cancer-specific, and non-cancer mortality. Furthermore, these associations were demonstrated in NHW women for all-cause and breast cancer-specific mortality when stratifying the association by ethnicity; however, the association was not observed for non-cancer mortality. There were no significant associations between MCS and mortality outcomes. This finding is in accordance with other studies that have reported no association between overall mental/psychosocial HRQOL and breast cancer prognosis (42, 50, 78, 89-92, 94). Although our results did not indicate evidence of an association between the MCS summary score and mortality there were associations present for two subscales (social functioning and vitality).

A comparison between these study findings and those reported in the literature is hindered due to differences in study design, subject characteristics, and the HRQOL

measures. This study controlled for demographic, clinical, and HRQOL prognostic factors that were found to influence the measure of effect by 10% or more. Distinguishing the impact of specific variables based on when they were evaluated is vital to consider. The 36-month follow-up consisted of many of the self-reported variables pertaining to mental/psychosocial or physical HRQOL, in addition to SF-36-related assessments. Ultimately, this study found that women who reported their HRQOL negatively had an increased risk of death.

Mental/Psychosocial HRQOL

Studies have evaluated some form of mental/psychosocial HRQOL as a predictor of survival or mortality in women diagnosed with breast cancer. This analysis found no evidence of association for overall mental/psychosocial HRQOL with mortality, which is consistent with findings reported by previous studies (42, 78-81, 89-92). However, in keeping with several studies (13, 14, 42, 43, 83, 87, 95) there was evidence of an association between eight mental/psychosocial-related subscales and mortality. In contrast to the finding of this study, Dumontier et al. reported that better mental health was associated with lower mortality in a study testing HRQOL in a predictive model for mortality, utilizing the Mental Health Index (MHI-5) from the SF-36 and 10-year follow-up data for women diagnosed with breast cancer (87). These results were strengthened with the addition of other HRQOL measures (physical health, mental health, social support) (87). These results suggest prognostic relevancy between HRQOL measures and breast cancer outcomes. Saquib et al. discovered that the mental health summary score in their sample was marginally associated with breast cancer recurrence and all-cause

mortality when alone, but the associations attenuated towards the null when evaluated via a multivariable model, similar to our study (89).

Seven studies reported significant associations between aspects of mental/psychosocial HRQOL and breast cancer survival or mortality (13, 14, 42, 43, 83, 87, 95). Goodwin et al. was similar in study size (N=397) and measured HRQOL post-diagnosis via the European Organization for Research and Treatment of Cancer Quality of Life Questionnaire-Core 30 (EORTC QLQ-C30), as well as other measures of HRQOL factors, with a median of 5.8 years of follow-up. Even though four significant associations were found between mental/psychosocial HRQOL and distant disease-free survival (DDFS) or overall survival, the researchers reported that seven significant associations would've been generated due to chance. They found that women with higher cognitive functioning had lower DDFS; opposite of what was hypothesized, perhaps bolstering their suggestion of deeming the associations inconclusive due to random error. Similarly, although Phillips et al., a quite larger study (N=708), discovered a connection between anxious preoccupation and worse DDFS and OS, there were no significant associations in the adjusted models, and the aforementioned report was driven more by the confounding of poor prognostic factors rather than a direct relationship (78). The two studies used some of the same surveys to assess mental/psychosocial health (42, 78).

Many studies found that out of a variety of evaluated mental/psychosocial prognostic factors, a couple showed significant relationships with breast cancer outcomes. Watson et al. reported that women with higher scores of helplessness/hopelessness were at risk of lower disease-free survival (14). Participants were evaluated via the Mental Adjustment to Cancer Scale (MAC) and for depression

(HADS) within 4-12 weeks post-diagnosis. Unlike our analysis, these mental/psychosocial factors were assessed immediately after diagnoses, potentially impacting the emotional response to cancer diagnoses, especially in a study evaluating early emotional response on survival. Conversely, participants in our study, who might have undergone treatment, could have reported emotional responses to their health differently if HRQOL evaluations were administered at baseline. De Aguiar et al. used the EORTC QLQ-C30 in a similar sized sample (N=549) and reported lower survival in participants who had worse future perspective (95). Though, helplessness/hopelessness and future perspective are unrelated, they share commonalities, and further research should explore the idea of the prognostic relevancy behind perceptions of disease burden.

Groenvold et al. reported associations between greater emotional functioning and better recurrence-free survival and overall survival, using the EORTC QLQ-C30 for HRQOL measures (13). The researchers claimed that their study is one of the first to find significant relationships between self-rated psychological factors and breast cancer recurrence and death, contrasting a handful of other studies previously cited (13). Conversely, this study found no associations between role emotional of the SF-36 and mortality. Even then, it's tough to speculate whether the two findings are in any way analogous, given that HRQOL was measured contrarily and distributed at different survivorship periods.

Among the aspects of mental/psychosocial HRQOL, social-related paradigms seemed to have significant relationships with breast cancer prognosis. Lehto et al. suggested that shorter survival was predicted by perceived support, though their classification of support as a covariate was created on the basis of hypothetical support

rather than support actually received by participants (43). Utilizing the General Quality of Life Inventory-74, Epplein et al. found that women with higher levels of social well-being had lower risks of mortality and breast cancer recurrence (83). This association is similar to ours when comparing it to the effects of levels of social functioning and all-cause and non-cancer mortality. In our study, participants in T1 of social functioning subscale had a 2.6 times increased likelihood of dying of non-cancer causes in the fully-adjusted model. Similar associations were found for all-cause mortality, but significance was lost when the relationship was adjusted for additional HRQOL-related characteristics. Another support-related variable, numbers of types of confidants, was adjusted for in the final models to control for social support mainly in associations between component summary scores and mortality. The social functioning subscale isn't built to include this specific concept, so controlling for it is appropriate.

The effects seen in the Epplein et al. study and ours share similarities in methodology and sample. Although the Epplein et al. study was far larger (N=2,230) (83), the sample contained *in-situ* cases and a predominant amount of Chinese women, whereas ours was composed of a mix of NHW and Hispanic women. They also categorized their HRQOL predictor variables into tertiles based on the distribution of their population sample (83). Epplein et al. evaluated HRQOL at baseline and 36-month follow-up, contrasting our study only assessing HRQOL-related variables during a follow-up around the same period post-diagnosis. However, Epplein et al. found no significant results between any HRQOL predictors and breast cancer survival or recurrence at 36-month follow-up (83). Additionally, as stated before, the validity of

comparisons of the two studies originates from how social support and social functioning is classified, defined, and measured.

A variety of factors play a role in the relationship between mental/psychosocial HRQOL and breast cancer prognosis. Among studies evaluating many of these factors, a large proportion of them find at least one significant association between a mental/psychosocial-related predictor and a breast cancer outcome (83). Although, as discussed above, some of these associations were calculated by chance (42), posing a problem with analyses evaluating many variables at once. However, the nature of HRQOL evolves from paradigms of multiple factors influencing health. Considering many aspects of health is essential but can result in analysis containing an oversaturated amount of variables when validated instruments encapsulating HRQOL may be more efficient. The relationship between overall PCS) and mortality remained consistent for all three mortality outcomes. When evaluating similar relationships between each physical-related subscale and mortality, several remained significant in fully-adjusted models.

Physical HRQOL

It has been suggested that poorer physical HRQOL is predictive of poorer breast cancer-related outcomes (50, 79-81, 87-94). In this study, the relationship between physical-related HRQOL and all-cause, breast cancer-specific, and non-cancer mortality were significant in fully-adjusted models. In fact, the association slightly strengthened for all-cause and non-cancer outcomes, and slightly attenuated for breast cancer-specific mortality.

Some researchers evaluated the prognostic value of physical-related factors, such as fatigue and pain (13, 91), inflammation (94), nausea/vomiting (79), and appetite loss (93) after a diagnosis of breast cancer. Instead of evaluating these factors as separate predictors, they were evaluated all as potential confounders and retained some in the final models (e.g., fatigue and pain) to account for their magnitudes of effects. Some of these factors may serve a proxy of reporting lower physical HRQOL.

Three studies have used SF-36 as the primary HRQOL measurement in breast cancer survivor populations (87-89). Saquib et al. and Marinac et al. both analyzed data from the Women's Healthy Eating and Living (WHEL) Study; both studies reporting analytic sample sizes near 3,000 participants (88, 89), majority NHW women, with a mean survival time of 7.3 years) (105). However, the two studies that utilized data from WHEL did adjust their regression models for race/ethnicity. (88, 89).

Saquib et al. reported that higher PCS had protective effects against recurrence and all-cause mortality (89). The researchers categorized physical health into quintiles by overall score (0-100), the higher the score, the better HRQOL (89). Even though the categorization of HRQOL differed, the takeaway message remained the same. Our findings parallel their study by comparing higher levels (healthier) of HRQOL to lower levels. Marinac et al. found that lower self-reported physical functioning was significantly associated with all-cause and breast cancer-specific mortality (88).

The Role of Chronic Stress and Inflammation

Marinac et al. suggested that inflammation might be partly responsible for the increased risk of mortality in women who report lower physical functioning

characteristics. In their study, BMI, physical activity, and C-reactive protein were all related to physical functioning. Extant research has suggested that stress and the social environment can exacerbate inflammatory responses to diseases (109), and inflammation is partly regulated by cortisol levels, specifically when stress is high, causing erratic increases in inflammation that may promote chronic disease (109, 143). Consequently, chronic stress is directly associated with cancer pathogenesis (111).

Stress and inflammation are full-body responses to internal and external factors. When evaluating self-reported data on HRQOL, it is important to consider stress and chronic inflammation as factors that can influence response bias to health-related questions as well as mediate associations between health-related predictors and disease outcomes. Additionally, weighing stress responses may be helpful, especially if they are associated with higher levels of inflammation. In a future study similar to ours where mental/psychosocial and physical HRQOL are evaluated, it would be interesting to see the effects of HRQOL as a whole (e.g., mental/psychosocial & physical combined) on breast cancer prognosis. Theoretically, since inflammation is associated with poorer HRQOL (94) and stress (143), then psychosocial factors that influence stress may be indicative of inflammatory responses that may worsen physical well-being as well. However, our measure of HRQOL does not account for an overall health status.. Nevertheless, the idea stands that levels of mental/psychosocial and physical HRQOL may be related via biological pathways.

Understanding why participants are answering HRQOL-related parameters as poor compared to healthy is important. Cancer diagnoses can elicit stress responses (111); therefore, it is essential to consider timing of HRQOL assessment during the post-

diagnosis period and whether assessment occurs pre- or post-treatment. Lower levels of HRQOL are indicative of lower overall well-being and worse survivorship in women previously diagnosed with breast cancer. Research surrounding these domains is vital in improving survivorship and understanding what may be responsible for low HRQOL and poorer prognosis.

HRQOL Evaluated in Other HEAL Studies

HRQOL has been evaluated in this study population previously; however, none of the previous studies have assessed HRQOL as a predictor of mortality (124, 149, 150, 166-173). The HEAL study was originally designed to examine the relationship between anthropometrics, body composition, lifestyle factors, hormone measurements, clinical characteristics, and other prognostic factors with early stage breast cancer (148).

Although the majority of previous HEAL HRQOL-related analyses have utilized data from all three study sites (New Mexico, Los Angeles County, Western Washington) (124, 149, 150, 167, 168, 170-173), this analysis is based on New Mexico site data only, which accounts for the majority of Hispanic subjects (148).

In one study, Meeske et al. found that correlates of fatigue were pain, cognitive problems, physical inactivity, weight gain, and antidepressant use (150). Additionally, fatigue and poorer HRQOL were associated (150). In our study, fatigue was analyzed as a confounder. In the univariate models to assess individual effects of covariates on the effect of HRQOL on mortality, fatigue was not significantly associated with MCS (had no effective change between the crude model and additional models) and for all-cause, breast cancer-specific, and non-cancer mortality, and thus was not retained in the

multivariable models. For PCS, fatigue was not evaluated since questions that compose the PCS contain aspects of fatigue.

Wayne et al. discovered that diet quality was associated with HRQOL, specifically for 3 of the 4 mental subscales and 2 of the 4 physical subscales (124). Though, our study didn't include diet quality, the results of the aforementioned study suggested that factors impacting HRQOL may also effect breast cancer prognosis through mediation. Another HEAL study concluded that better physical activity was associated with better physical HRQOL (166). Additionally, in another HEAL analysis, lack of physical activity and weight gain was associated with risk for pain (149). Unlike fatigue, bodily pain was included in multivariable analyses for MCS and all-cause and non-cancer mortality, attenuating the crude associations. When evaluating MCS and all-cause mortality, pain altered the effects by 38.2% (T1) and 24.0% (T2). This may suggest that self-reported pain plays a significant role in the relationship between mental/psychosocial HRQOL and mortality. An issue with self-reported pain falls in its subjectivity—participants with low mental HRQOL may be more likely to report higher levels of pain related to mental/psychosocial factors rather than physical ones (or vice versa)—and this phenomena is damaging if pain-related assessments presume to be homologous with physiological experiences.

Studies utilizing the HEAL data have found significant prognostic differences between ethnicities (167, 168, 173, 174). Although differences in ethnicity (NHW vs. Hispanic) weren't of main focus in this study, the analyses between HRQOL and mortality were stratified by ethnicity to see if a single group could explain some of the survival disparity. Since the sample size of Hispanics in the present analysis is low

(n=78), including only five deaths, it is difficult to determine whether the present findings are due to chance.

Moreover, when stratifying associations between MCS/PCS and mortality by ethnicity, NHW women with poorer physical HRQOL were twice as likely to die compared to NHW women with better physical HRQOL. While a similar relationship was observed for NHW and breast cancer-specific and non-cancer mortality, these associations were not significant. A similar phenomenon was discerned for Hispanic women in the all-cause mortality model. Hispanic women with worse PCS were four times as likely to die by all-causes compared to Hispanics with better PCS, though this association wasn't significant (HR: 4.05, 95% CI: 0.82, 20.05).

Strengths and Limitations

This study has several strengths. It utilized a variety of validated and standardized measures for HRQOL and collected data on a number of self-reported HRQOL-related covariates, which allowed for an evaluation of potential confounders (35). Additionally, clinical data were abstracted from medical records and from the SEER registry and used for further evaluation of confounding. Deaths were confirmed via the National Death Index, a reliable approach to validating consistent death counts and survival time. Results were based on a median of 11 years of survival time, which permitted an assessment of long-term survival in relation to HRQOL.

This study has another strength. Since three assessments were of interest, I was able to utilize variables from three time points (baseline, 24-month follow-up, HRQOL

assessment). Some of these variables, such as demographics, were consistently available at each point of assessment.

Another strength includes the model building process. Accounting for the joint effects of significant covariates created the most parsimonious models. This study also utilized additional HRQOL-related variables that were not included in the construction of the SF-36. If variables were included in the construction of the MCS, and they held relevancy as a confounder in the model building process, then they were adjusted for in the PCS model, and vice versa. For example, bodily pain was controlled for in associations between MCS and mortality, but not PCS and mortality. This was calculated to consider how much of the effect is impacted by physical-related factors in mental/psychosocial models and vice versa.

Utilizing cases with only invasive breast cancer is another strength. Women with *in-situ* breast cancer experience an approximate 95% survival rate after five years (1). Thus, it is suggested that these women may undergo different survivorship experiences compared to women diagnosed with higher stages of disease.

Our analysis has several limitations that require thorough consideration. HRQOL was evaluated 36-months post-diagnosis, and cases who died prior to the assessment may or may not of had a poorer HRQOL. Associations between HRQOL and breast cancer mortality may be underestimated in comparison to findings derived from utilizing a HRQOL assessment at baseline. Additionally, one reason why the data has limited breast cancer-specific mortality events is because 63.5% (n=47) of women who died of breast cancer died before the HRQOL assessment was conducted, and this can create a survival bias.

Furthermore, data was lacking for of multiple HRQOL measures over time. Measuring HRQOL at baseline and 24-month assessment, in addition to 36-months post-diagnosis, would have presented opportunities to clarify uncertainty behind causal pathways, such as unveiling what factors are correlated with poorer HRQOL during each follow-up. More opportunities to evaluate changes of HRQOL and its impact on breast cancer prognosis would be valuable. Also, I would have had the ability to measure these associations directly after diagnosis in comparison to 36-months post-diagnosis, considering factors such as treatment and the effects of HRQOL on short-term breast cancer survival.

It was difficult to detect the presence of an effect due to small sample size and too few deaths. However, the evaluation of this underrepresented population has added relevant data to the overall literature. Another limitation includes the fact that I may have missed residual confounding by unmeasured measures (e.g., inflammation, stress). Nevertheless, this research question needs to be tested on other populations, especially ones with ethnic demographics.

This study may not indicate a direct causal relationship between HRQOL predictors and breast cancer mortality, but as suggested, the current associations may be representative of additional unmeasured prognostic factors. Physical HRQOL was predictive of all mortality outcomes, and NHW women drove the effect. However, associations with MCS were inconsistent and only remained significant in relationships between few individual subscales and mortality outcomes. Conversely, these findings may elucidate specific relationships between aspects of mental/psychosocial HRQOL and breast cancer prognosis, since a majority of studies evaluating similar associations find at

least one association between a mental/psychosocial factor and breast cancer prognosis (83). More attention may need to be paid toward the specific factors suggesting poorer prognosis.

Conclusions

In summary, this analysis has demonstrated a significant prognostic value between items include in a validated HRQOL instrument (mental/psychosocial, physical), and breast cancer-specific mortality in a unique population of women diagnosed with invasive breast cancer. This study also revealed significant associations between HRQOL and mortality in breast cancer survivors by ethnicity. This study appears to be the first to evaluate HRQOL as a predictor of mortality in a population of ethnically diverse breast cancer survivors. Although based on a small sample, study findings suggest that the association between HRQOL and mortality should be addressed in future research, specifically among Hispanic women with breast cancer. Additional research in a larger sample of minority populations will bolster a better understanding of HRQOL as a predictor of breast cancer prognosis (survival, mortality, recurrence). Such research may provide important data for interventions designed to improve overall well-being among breast cancer survivors.

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APPENDICES

Appendix A. Studies Evaluating Health-Related Quality of Life (HRQOL) as a Predictor of Breast Cancer Prognosis

#	Authors	Study Sample	Study Measures	Date(s) Assessed	Outcome Measures	Survival Time	Findings
1	Coates et al., 2000	Participants: Trial VI (*n*=1,262) and Trial VII (*n*=1,008) at baseline; (*n*=869) of Trial VI and (*n*=742) of Trial VII at 18 months. At 1 month after relapse: (*n*=203) Trial VI and (*n*=149) Trial VII. At 6 months after relapse: (*n*=219) Trial VI and (*n*=162) Trial VII	Linear Analog Self-Assessment (LASA)	Regular intervals for 6 years after randomization or until relapse; 1- and 6-months post-disease relapse	Disease-free survival (DFS) and overall survival	Not provided	Six months after relapse: Better physical well-being in premenopausal women (HR: 0.91, p-value: 0.03) and postmenopausal women (HR: 0.85, p-value: <0.0001) predicted longer survival. Mood (HR: 0.88, p-value: 0.002) and coping (HR: 0.85, p-value: 0.0001) predicted longer survival in postmenopausal women.
2	Shimozuma et al., 2000	(*n*=19)	Quality of Life Questionnaire for Cancer Patients Treated with Anticancer Drugs (QOL-ACD)	Baseline and once a month	Overall survival	After first assessment: 14 months (range: 1-37 months); after last assessment: 4 months (range: 0-21 months)	Physical elements of quality of life predicted survival, but psychosocial elements did not.
3	Luoma et al., 2003	(*n*=283)	EORTC QLQ-C30	Not provided	Time to progression (TTP) and overall survival (OS)	T group: 10.4 months; MF group: 11.4 months (range: 6 days to 29 months for both)	More severe fatigue (HR: 1.48, 95% CI: 1.13-1.93, p-value: 0.0044) and pain (HR: 1.46, 95% CI: 1.10-1.94, p-value: 0.008) were associated with shorter overall survival.

#	Authors	Study Sample	Study Measures	Date(s) Assessed	Outcome Measures	Survival Time	Findings
4	Efficace et al., 2004	(*n*=359), women from 12 countries	EORTC QLQ-C30	Baseline (just after randomization, before treatment)	Overall survival	Not provided	Inflammatory breast cancer was significantly associated with worse survival (HR: 1.38, 95% CI: 1.03-1.84, p-value: 0.030)
5	Goodwin et al., 2004	(*n*=397)	EORTC QLQ-C30; Profile of Mood States (POMS); Total Mood Disturbance (TMD) score; Impact of Events Scale (IES); Mental Adjustment to Cancer (MAC) scale; Courtauld Emotional Control Scale (CECS); Psychosocial Adjustment to Illness Scale Self-Report (PAIS-SR)	Baseline (mean: 9.7, SD: 5.2 weeks) after diagnosis. 1-year follow-up (mean: 57.4, SD: 7.7 weeks) after diagnosis	Distant disease-free survival (DDFS) and overall survival (OS)	Not provided	Cognitive functioning (HR: 1.76, p-value: 0.04) of distant recurrence (or reduced distant disease-free survival); Domestic environment (HR: 1.48, p-value: 0.049) of overall survival; Avoidance (HR: 0.48, p-value: 0.014) of overall survival
6	Watson et al., 2005	(*n*=578)	Hospital Anxiety and Depression Scale (HADS); Mental Adjustment to Cancer Scale (MAC)	1-3 Months post-diagnosis (baseline), 5-year, and 10-year post-diagnoses	Disease-free survival and overall survival	Not provided	After 10-years, women with higher helplessness/hopelessness scores had increased risk of breast cancer death or relapse (HR: 1.53; 95% CI: 1.11-2.11)

#	Authors	Study Sample	Study Measures	Date(s) Assessed	Outcome Measures	Survival Time	Findings
7	Lehto et al., 2006	(*n*=102)	Chronic Strains Survey (CSS), the Rotterdamn Symptom Checklist (RSCL), 10-item Depression Scale (DEPS), EORTC-breast 23.	3-4 Months post-diagnosis	Overall survival	Not provided	High education and distancing predicted better overall survival (HR: 0.08, p-value: 0.003); (HR: 0.78; p-value: 0.034). Behavioral escape-avoidance (HR: 1.38, p-value: 0.008), emotional defensiveness (HR: 1.31, p-value: 0.007) and perceived support (HR: 5.19; p-value: 0.009) predicted worse survival.
8	Groenvold et al., 2007	(*n*=1,588)	EORTC QLQ-C30; Hospital Anxiety and Depression Scale (HADS)	Approximately 4-months post-diagnosis	Recurrence-free survival (RFS) and overall survival (OS)	Not provided	Higher levels of emotional functioning predicted better recurrence-free survival (RFS) (RR: 0.80; 95% CI: 0.69-0.93) and overall survival (OS) (RR: 0.81; 95% CI: 0.70-0.95). Higher levels of fatigue predicted worse RFS (RR: 1.32; 95% CI: 1.13-1.54) and OS (RR: 1.23; 95% CI: 1.05-1.44).
9	Gupta et al., 2007	(*n*=251)	Ferrans and Powers quality of life index (QLI)	At time of diagnosis	Overall survival	Not provided	Higher scores in the health and physical subscale (RR: 0.91, 95% CI: 0.86-0.96, p-value: <0.001) and overall HRQOL (RR: 0.90, 95% CI: 0.85-0.95, p-value: <0.001) were associated with better survival.

#	Authors	Study Sample	Study Measures	Date(s) Assessed	Outcome Measures	Survival Time	Findings
10	Phillips et al., 2008	(*n*=708)	Hospital Anxiety and Depression Scale (HADS), Mental Adjustment to Cancer Scale (MAC), Courtauld Emotional Control Scale (CECS), and the Duke-University of North Carolina Functional Social Support (DUFSS) questionnaire	2-42-Months post-diagnosis (median: 11 months)	Distant disease-free survival (DDFS) and overall survival (OS)	Not provided	There were no statistically significant associations between the HRQOL/psychosocial variables and DDFS and OS when adjusted for known prognostic factors.
11	Quinten et al., 2009	(*n*=30) randomized control trials, (*n*=7,417) HRQOL present at baseline	EORTC QLQ-C30	N/A	Overall survival	Median: 18.77 months (95% CI: 17.42, 19.98)	Physical functioning (HR: 0.94; 95% CI: 0.92, 0.96), pain (HR: 1.04; 95% CI: 1.02-1.06), and appetite loss (HR: 1.05; 95% CI: 1.03-1.06) were significant prognostic factors of overall cancer survival.
12	Sarenmalm et al., 2009	(*n*=67) Trial 12-93, (*n*=74) Trial 14-93	IBCSG Quality of Life Core Questionnaire	Performed during the trials at randomization, and at 3, 6, 9, 12, and 18 months, followed by annual follow-ups over 6-years post-randomization	Breast cancer recurrence	Not provided	Nausea/vomiting (β: -0.006, p-value: 0.013) and physical well-being (β: 0.004, p-value: 0.047) predict breast cancer recurrence.

#	Authors	Study Sample	Study Measures	Date(s) Assessed	Outcome Measures	Survival Time	Findings
13	Bredal et al., 2011	(*n*=195)	EORTC QLQ-C30; Hospital Anxiety and Depression Scale (HADS)	At time of diagnosis and 1-year post-diagnosis	Disease-free survival (DFS)	Median: 2.5 years (range: 0.9-7.4 years)	Appetite loss was significantly associated with worse survival (HR: 2.92, 95% CI: 1.50-5.66, p-value: 0.002)
14	Disipio et al., 2011	(*n*=287)	Functional Assessment of Cancer Therapy, General (FACT-G) & Breast (FACT-B+4)	HRQOL assessed at 6-, 12-, and 18-months post-diagnosis	Overall survival (OS), changes over time	Overall survival time not provided. However, mean survival times by associations were.	Physical well-being, emotional well-being, functional well-being, breast cancer concerns, FACT-G, and FACT-B+4 all showed significant changes over time (6 to 12 to 18 months post-diagnosis). Women who reported stable/improving physical well-being had better survival than women who reported declining physical well-being (HR: 0.24; 95% CI: 0.08-0.70). The same applied to functional well-being (HR: 0.35; 95% CI: 0.14-0.87).

#	Authors	Study Sample	Study Measures	Date(s) Assessed	Outcome Measures	Survival Time	Findings
15	Epplein et al., 2011	(n=2,230) baseline, (n=1,845) 36-months post-diagnosis	General Quality of Life Inventory-74	At 6-months and 36-months post-diagnosis	All-cause mortality and breast cancer recurrence	From 6-month survey: 4.9 years for women who lived and 2.3 years for women who died. From 36-month follow-up: 2.4 years for women who lived and 1.2 years for women who died.	At baseline, a higher psychological well-being and a higher social well-being were associated with better mortality (HR: 0.66; 95% CI: 0.49-0.88); (HR: 0.52; 95% CI: 0.38-0.71). There were no significant associations at follow-up.
16	Saquib et al., 2011	(*n*=2,967)	Thoughts and Feelings Questionnaire (included the Medical Outcomes Study (MOS) Short-Form Survey (SF-36))	Baseline	Additional breast cancer events and all-cause mortality	Not provided	Higher levels of physical health predicted lower additional breast cancer events (p-trend: 0.005) and lower risk of all-cause mortality (p-trend: 0.004)
17	De Aguiar et al., 2014	(*n*=1,002) beginning of the follow-up, (*n*=766) 4-year follow-up, (n=549) QOL evaluation	EORTC QLQ-C30 and the BR23 module	About 4 years after surgery	Overall survival	Mean: 23 months, SD: 3.9 months	Worse future perspective was associated with a higher likelihood of death (HR: 3.46, 95% CI: 1.36-8.79, p-value: 0.009).

#	Authors	Study Sample	Study Measures	Date(s) Assessed	Outcome Measures	Survival Time	Findings
18	Marinac et al., 2014	(*n*=2,892)	10-item physical function subscale (PF-10) of the Medical Outcomes Study (MOS) Short Form-36 (SF-36)	Baseline	All-cause mortality and breast cancer-specific mortality	Not provided	Compared to adequate and high physical functioning, participants with low physical functioning were more likely to die by all-causes (HR: 1.49, 95% CI: 1.17-1.89) and breast cancer-specific-causes (HR: 1.39, 95% CI: 1.07-1.80)
19	DuMontier et al., 2018	(*n*=660)	Medical Outcomes Study (MOS) 36-item Short-Form Survey (SF-36) and MOS Social Support Survey (mMOS-SSS)	Within the year post-surgery	All-cause mortality	10-years	In the fully adjusted model, better levels of mental health (OR: 0.56, 95% CI: 0.37-0.83) and physical functioning (OR: 0.64, 95% CI: 0.44-0.94) were associated with lower mortality.

Appendix B. Physical Component Summary Score Univariate HR Analysis and Percent Change for All-Cause Mortality when Assessing for Potential Confounders (*N* = 351)

Model	Variable(s) in model	Categories	Total in categories (n)	Total in model (n); dead (d)	Missing	Univariate-Cox HR (95% CI)	p-values*	PCS HR (95% CI) and p-values	% change from crude model
Crude	Physical Component Summary Score (PCS)	0: ≤ 44.75 1: > 44.75 & ≤ 54.39 2: > 54.39 (REF)	0: 117 1: 117 2: 117	n=351 d=99	0	0: HR=3.80 (2.20-6.54) 1: HR=1.67 (0.91-3.07)	**p=<0.0001**	0: HR=3.80 (2.20-6.54) p(PCS)=<0.0001 1: HR=1.67 (0.91-3.07) p(PCS)=0.0963	--
1	Age	Continuous	--	n=351 d=99	0	HR=1.06 (1.04-1.08)	**p=<0.0001**	0: HR=2.37 (1.34-4.19) p(PCS)=0.0030 1: HR=1.29 (0.69-2.39) p(PCS)=0.4138 p(Age)=<0.0001	**0: 37.63%** **1: 29.46%**
2	Race/Ethnicity	0: Non-Hispanic White (REF) 1: Hispanic	0: 273 1: 78	n=351 d=99	0	0: HR=1.00 1: HR=0.66 (0.38-1.12)	**p=0.1231**	0: HR=3.80 (2.21-6.56) p(PCS)=<0.0001 1: HR=1.68 (0.92-3.08) p(PCS)=0.0944 p(Ethnicity)=0.1231	0: 0.00% 1: 0.60%
3	Marital Status	0: Single 1: Married (REF)	0: 160 1: 191	n=351 d=99	0	0: HR=1.75 (1.17-2.64) 1: HR=1.00	**p=0.0067**	0: HR=3.52 (2.04-6.09) p(PCS)=<0.0001 1: HR=1.66 (0.91-3.05) p(PCS)=0.1003 p(Marital)=0.0067	0: 7.37% 1: 0.60%

Model	Variable(s) in model	Categories	Total in categories (n)	Total in model (n); dead (d)	Missing	Univariate-Cox HR (95% CI)	p-values*	PCS HR (95% CI) and p-values	% change from crude model
4	Tumor Stage	0: Localized (I) 1: Regional (II-IIIa)	0: 276 1: 75	n=351 d=99	0	0: HR=1.00 1: HR=1.25 (0.79-1.98)	p=0.3405	0: HR=3.84 (2.23-6.63) p(PCS)=<0.0001 1: HR=1.69 (0.92-3.10) p(PCS)=0.0904 p(Stage)=0.3405	0: 1.05% 1: 1.20%
5	Breast Cancer Treatment Type	0: Surgery only (REF) 1: Any chemotherapy 2: Surgery and radiation	0: 98 1: 109 2: 144	n=351 d=99	0	0: HR=1.00 1: HR=0.80 (0.48-1.32) 2: HR=0.73 (0.46-1.16)	p=0.3937	0: HR=3.73 (2.16-6.44) p(PCS)=<0.0001 1: HR=1.66 (0.90-3.04) p(PCS)=0.1023 p(Treatment1)=0.3827 p(Treatment2)=0.1795	0: 1.84% 1: 0.60%
6	Comorbidities	0: Zero (REF) 1: One or more	0: 298 1: 53	n=351 d=99	0	0: HR=1.00 1: HR=1.52 (0.94-2.45)	**p=0.0864**	0: HR=3.50 (2.01-6.09) p(PCS)=<0.0001 1: HR=1.61 (0.87-2.96) p(PCS)=0.1266 p(Comorbidities)=0.0864	0: 7.89% 1: 3.59%
7	Current Lymphedema	0: No (REF) 1: Yes	0: 307 1: 44	n=351 d=99	0	0: HR=1.00 1: HR=0.55 (0.28-1.09)	**p=0.0524**	0: HR=4.08 (2.36-7.05) p(PCS)=<0.0001 1: HR=1.74 (0.95-3.20) p(PCS)=0.0731 p(Lymphedema)=0.0524	0: 7.37% 1: 4.19%

Model	Variable(s) in model	Categories	Total in categories (n)	Total in model (n); dead (d)	Missing	Univariate-Cox HR (95% CI)	p-values*	PCS HR (95% CI) and p-values	% change from crude model
8	Perceived Optimism	0: ≤ 10 1: > 10 (REF)	0: 83 1: 268	n=351 d=99	0	0: HR=1.25 (0.81-1.93) 1: HR=1.00	p=0.3160	0: HR=3.61 (2.07-6.28) p(PCS)=<0.0001 1: HR=1.64 (0.90-3.02) p(PCS)=0.1093 p(Optimism)=0.3160	0: 5.00% 1: 1.80%
9	Perceived Pessimism	0: ≤ 10 (REF) 1: > 10	0: 255 1: 96	n=351 d=99	0	0: HR=1.00 1: HR=1.42 (0.93-2.15)	**p=0.1009**	0: HR=3.54 (2.04-6.14) p(PCS)=<0.0001 1: HR=1.64 (0.89-3.01) p(PCS)=0.1114 p(Pessimism)=0.1009	0: 6.84% 1: 1.80%
10	Number of Types of Confidants	0: < 3 1: 4-5 2: > 5 (REF)	0: 66 1: 172 2: 113	n=351 d=99	0	0: HR=1.78 (1.02-3.08) 1: HR=1.28 (0.79-2.06) 2: HR=1.00	**p=0.1226**	0: HR=3.84 (2.23-6.62) p(PCS)=<0.0001 1: HR=1.73 (0.94-3.18) p(PCS)=0.0761 p(Confidant0)=0.0412 p(Confidant1)=0.3118	0: 1.05% 1: 3.59%
11	Fear of Recurrence	0: No (REF) 1: Yes	0: 154 1: 197	n=351 d=99	0	0: HR=1.00 1: HR=0.69 (0.47-1.03)	**p=0.0674**	0: HR=3.78 (2.19-6.52) p(PCS)=<0.0001 1: HR=1.68 (0.92-3.09) p(PCS)=0.0935 p(Fear)=0.0674	0: 0.53% 1: 0.60%

Model	Variable(s) in model	Categories	Total in categories (n)	Total in model (n); dead (d)	Missing	Univariate-Cox HR (95% CI)	p-values*	PCS HR (95% CI) and p-values	% change from crude model
Crude	PCS (restricted to those with education)		0: 116 1: 117 2: 117	n=350 d=98		0: HR=3.74 (2.17-6.45) 1: HR=1.67 (0.91-3.07)	**p=<0.0001**	0: HR=3.74 (2.17-6.45) p(PCS)=<0.0001 1: HR=1.67 (0.91-3.07) p(PCS)=0.0963	--
12	Education	0: High school or less 1: Some college 2: College graduate 3: Graduate school (REF)	0: 92 1: 114 2: 70 3: 74	n=350 d=98	1	0: HR=1.65 (0.90-3.02) 1: HR=1.28 (0.71-2.32) 2: HR=0.92 (0.44-1.91) 3: HR=1.00	**p=0.2352**	0: HR=3.43 (1.97-5.98) p(PCS)=<0.0001 1: HR=1.55 (0.84-2.86) p(PCS)=0.1587 p(Education0)=0.1087 p(Education1)=0.4054 p(Education2)=0.8174	0: 8.29% 1: 7.19%
Crude	PCS (restricted to those with tumor size)		0: 116 1: 114 2: 111	n=341 d=99		0: HR=3.66 (2.12-6.30) 1: HR=1.65 (0.90-3.02)	**p=<0.0001**	0: HR=3.66 (2.12-6.30) p(PCS)=<0.0001 1: HR=1.65 (0.90-3.02) p(PCS)=0.1069	--
13	Tumor Size	0: < 3 cm (REF) 1: ≥ 3 cm	0: 304 1: 37	n=341 d=99	10	0: HR=1.00 1: HR=1.25 (0.68-2.29)	p=0.4712	0: HR=3.66 (2.12-6.30) p(PCS)=<0.0001 1: HR=1.63 (0.89-3.00) p(PCS)=0.1142 p(Size)=0.4712	0: 0.00% 1: 1.21%

Model	Variable(s) in model	Categories	Total in categories (n)	Total in model (n); dead (d)	Missing	Univariate-Cox HR (95% CI)	p-values*	PCS HR (95% CI) and p-values	% change from crude model
Crude	PCS (restricted to those with lymph node involvement)		0: 113 1: 112 2: 116	n=341 d=92		0: HR=3.96 (2.26-6.94) 1: HR=1.63 (0.87-3.07)	**p=<0.0001**	0: HR=3.96 (2.26-6.94) p(PCS)=<0.0001 1: HR=1.63 (0.87-3.07) p(PCS)=0.1308	--
14	Lymph Node Involvement	0: None (REF) 1: ≥ 1 lymph node involved	0: 264 1: 77	n=341 d=92	10	0: HR=1.00 1: HR=1.32 (0.83-2.10)	**p=0.2435**	0: HR=4.02 (2.29-7.05) p(PCS)=<0.0001 1: HR=1.64 (0.87-3.10) p(PCS)=0.1239 p(Lymph node)=0.6706	0: 1.52% 1: 0.61%
Crude	PCS (restricted to those with Tamoxifen use, smoking status, and physical activity)		0: 107 1: 110 2: 113	n=330 d=91		0: HR=3.55 (2.04-6.17) 1: HR=1.56 (0.84-2.90)	**p=<0.0001**	0: HR=3.55 (2.04-6.17) p(PCS)=<0.0001 1: HR=1.56 (0.84-2.90) p(PCS)=0.1556	--
15	Tamoxifen Use	0: No 1: Yes (REF)	0: 160 1: 170	n=330 d=91	21	0: HR=1.18 (0.78-1.79) 1: HR=1.00	p=0.4226	0: HR=3.56 (2.05-6.19) p(PCS)=<0.0001 1: HR=1.55 (0.84-2.87) p(PCS)=0.1659 p(Tamoxifen)=0.4226	0: 0.28% 1: 0.64%

Model	Variable(s) in model	Categories	Total in categories (n)	Total in model (n); dead (d)	Missing	Univariate-Cox HR (95% CI)	p-values*	PCS HR (95% CI) and p-values	% change from crude model
16	Smoking Status	0: Never (REF) 1: Former 2: Current	0: 145 1: 144 2: 41	n=330 d=91	21	0: HR=1.00 1: HR=1.02 (0.66-1.60) 2: HR=1.25 (0.66-2.34)	p=0.7825	0: HR=3.51 (2.02-6.11) p(PCS)=<0.0001 1: HR=1.55 (0.83-2.87) p(PCS)=0.1671 p(Smoker1)=0.9169 p(Smoker2)=0.4933	0: 1.13% 1: 0.64%
17	Physical Activity	0: None 1: Low 2: Moderate/Vigorous (REF)	0: 185 1: 59 2: 86	n=330 d=91	21	0: HR=1.48 (0.86-2.56) 1: HR=0.80 (0.38-1.68) 2: HR=1.00	**p=0.0842**	0: HR=3.35 (1.90-5.88) p(PCS)=<0.0001 1: HR=1.49 (0.80-2.77) p(PCS)=0.2065 p(PA0)=0.1621 p(PA1)=0.5513	0: 5.63% 1: 4.49%
Crude	PCS (restricted to those with BMI)		0: 106 1: 110 2: 108	n=324 d=85		0: HR=3.48 (1.94-6.24) 1: HR=1.71 (0.90-3.24)	**p=<0.0001**	0: HR=3.48 (1.94-6.24) p(PCS)=<0.0001 1: HR=1.71 (0.90-3.24) p(PCS)=0.1011	--

Model	Variable(s) in model	Categories	Total in categories (n)	Total in model (n); dead (d)	Missing	Univariate-Cox HR (95% CI)	p-values*	PCS HR (95% CI) and p-values	% change from crude model
18	Body Mass Index (BMI)	0: <25 (REF) 1: 25-29 2: ≥30	0: 161 1: 99 2: 64	n=324 d=85	27	0: HR=1.00 1: HR=0.80 (0.48-1.34) 2: HR=1.15 (0.68-1.95)	p=0.4604	0: HR=3.43 (1.89-6.23) p(PCS)=<0.0001 1: HR=1.71 (0.90-3.25) p(PCS)=0.1028 p(BMI1)=0.3879 p(BMI2)=0.6073	0: 1.44% 1: 0.00%
Crude	PCS (restricted to those tumor subtype)		0: 102 1: 101 2: 97	n=300 d=87		0: HR=3.37 (1.88-6.04) 1: HR=1.79 (0.95-3.38)	**p=<0.0001**	0: HR=3.37 (1.88-6.04) p(PCS)=<0.0001 1: HR=1.79 (0.95-3.38) p(PCS)=0.0733	--
19	Tumor Subtype	0: ER+ (REF) 1: ER-	0: 251 1: 49	n=300 d=87	51	0: HR=1.00 1: HR=1.29 (0.75-2.23)	p=0.3553	0: HR=3.43 (1.91-6.15) p(PCS)=<0.0001 1: HR=1.78 (0.94-3.37) p(PCS)=0.0745 p(Subtype)=0.3553	0: 1.78% 1: 0.56%

*Bolded p-values are <0.25.

Appendix C. Percent Change from Crude Model and Model 1 with Each Potential Confounder (PCS & All-Cause Mortality) (*N* = 351)

Model	Variable(s) in model	Physical Component Summary Score (PCS) HR (95% CI)	Difference in 'N'	Total in model (n) and total dead (d)	% change from Crude	% change from model 1
Dataset restricted to those diagnosed with invasive breast cancer who have HRQOL and baseline covariates data						
Crude	Physical Component Summary Score (PCS)	0: HR=3.80 (2.20-6.54) 1: HR=1.67 (0.91-3.07) 2: HR=1.00 (REF) p=<0.0001	0	n=351 d=99	--	--
1	Age, Marital Status, & Tumor Stage	0: HR=2.32 (1.30-4.11) 1: HR=1.34 (0.72-2.47) 2: HR=1.00 (REF) p=0.0052	0	n=351 d=99	**0: 38.95%** **1: 19.76%**	--
2	Model 1 + Race/Ethnicity	0: HR=2.34 (1.32-4.15) 1: HR=1.34 (0.72-2.48) 2: HR=1.00 (REF) p=0.0048	0	n=351 d=99	**0: 38.42%** **1: 19.76%**	0: 0.86% 1: 0.00%
3	Model 1 + Treatment Type	0: HR=2.25 (1.27-3.98) 1: HR=1.29 (0.69-2.40) 2: HR=1.00 (REF) p=0.0065	0	n=351 d=99	**0: 40.79%** **1: 22.75%**	0: 3.02% 1: 3.73%

Model	Variable(s) in model	Physical Component Summary Score (PCS) HR (95% CI)	Difference in 'N'	Total in model (n) and total dead (d)	% change from Crude	% change from model 1
4	Model 1 + Comorbidities	0: HR=2.21 (1.24-3.95) 1: HR=1.31 (0.71-2.43) 2: HR=1.00 (REF) p=0.0109	0	n=351 d=99	**0: 41.84%** **1: 21.56%**	0: 4.74% 1: 2.24%
5	Model 1 + Current Lymphedema	0: HR=2.45 (1.37-4.37) 1: HR=1.37 (0.74-2.55) 2: HR=1.00 (REF) p=0.0033	0	n=351 d=99	**0: 35.53%** **1: 17.76%**	0: 5.60% 1: 2.24%
6	Model 1 + Optimism	0: HR=2.23 (1.25-3.97) 1: HR=1.32 (0.71-2.44) 2: HR=1.00 (REF) p=0.0099	0	n=351 d=99	**0: 41.32%** **1: 20.96%**	0: 3.88% 1: 1.49%
7	Model 1 + Pessimism	0: HR=2.17 (1.23-3.83) 1: HR=1.36 (0.74-2.51) 2: HR=1.00 (REF) p=0.0156	0	n=351 d=99	**0: 42.89%** **1: 18.56%**	0: 6.47% 1: 1.49%
8	Model 1 + Number of Types of Confidants	0: HR=2.34 (1.32-4.15) 1: HR=1.36 (0.73-2.51) 2: HR=1.00 (REF) p=0.0051	0	n=351 d=99	**0: 38.42%** **1: 18.56%**	0: 0.86% 1: 1.49%

Model	Variable(s) in model	Physical Component Summary Score (PCS) HR (95% CI)	Difference in 'N'	Total in model (n) and total dead (d)	% change from Crude	% change from model 1
9	Model 1 + Fear of Recurrence	0: HR=2.34 (1.32-4.16) 1: HR=1.34 (0.72-2.49) 2: HR=1.00 (REF) p=0.0047	0	n=351 d=99	**0: 38.42%** **1: 19.76%**	0: 0.86% 1: 0.00%
Subset--Restricted to participants with Education variable						
Crude	Physical Component Summary Score (PCS)	0: HR=3.74 (2.17-6.45) 1: HR=1.67 (0.91-3.07) 2: HR=1.00 (REF) p=<0.0001	1	n=350 d=98	--	--
1	Age, Marital Status, & Tumor Stage	0: HR=2.29 (1.29-4.07) 1: HR=1.33 (0.72-2.47) 2: HR=1.00 (REF) p=0.0063	1	n=350 d=98	**0: 38.77%** **1: 20.36%**	--
10	Model 1 + Education	0: HR=2.26 (1.28-4.02) 1: HR=1.31 (0.71-2.43) 2: HR=1.00 (REF) p=0.0076	1	n=350 d=98	**0: 39.57%** **1: 21.56%**	0: 1.31% 1: 1.50%
Subset--Restricted to participants with the Tumor Size variable						

Model	Variable(s) in model	Physical Component Summary Score (PCS) HR (95% CI)	Difference in 'N'	Total in model (n) and total dead (d)	% change from Crude	% change from model 1
Crude	Physical Component Summary Score (PCS)	0: HR=3.66 (2.12-6.30) 1: HR=1.65 (0.90-3.02) 2: HR=1.00 (REF) p=<0.0001	10	n=341 d=99	--	--
1	Age, Marital Status, & Tumor Stage	0: HR=2.30 (1.30-4.07) 1: HR=1.34 (0.73-2.49) 2: HR=1.00 (REF) p=0.0059	10	n=341 d=99	**0: 37.16%** **1: 18.79%**	--
11	Model 1 + Tumor Size	0: HR=2.25 (1.28-3.98) 1: HR=1.30 (0.70-2.41) 2: HR=1.00 (REF) p=0.0064	10	n=341 d=99	**0: 38.52%** **1: 21.21%**	0: 2.17% 1: 2.99%
Subset--Restricted to participants with Lymph Node Involvement variable						
Crude	Physical Component Summary Score (PCS)	0: HR=3.96 (2.26-6.94) 1: HR=1.63 (0.87-3.07) 2: HR=1.00 (REF) p=<0.0001	10	n=341 d=92	--	--

Model	Variable(s) in model	Physical Component Summary Score (PCS) HR (95% CI)	Difference in 'N'	Total in model (n) and total dead (d)	% change from Crude	% change from model 1
1	Age, Marital Status, & Tumor Stage	0: HR=2.36 (1.30-4.25) 1: HR=1.35 (0.71-2.56) 2: HR=1.00 (REF) p=0.0071	10	n=341 d=92	**0: 40.40%** **1: 17.18%**	--
12	Model 1 + Lymph Node Involvement	0: HR=2.34 (1.30-4.24) 1: HR=1.34 (0.71-2.55) 2: HR=1.00 (REF) p=0.0076	10	n=341 d=92	**0: 40.91%** **1: 17.79%**	0: 0.85% 1: 0.74%
Subset--Restricted to participants with Tamoxifen Use, Smoking Status, & Physical Activity variables (24-month follow-up)						
Crude	Physical Component Summary Score (PCS)	0: HR=3.55 (2.04-6.17) 1: HR=1.56 (0.84-2.90) 2: HR=1.00 (REF) p=<0.0001	21	n=330 d=91	--	--
1	Age, Marital Status, & Tumor Stage	0: HR=2.18 (1.22-3.91) 1: HR=1.24 (0.66-2.34) 2: HR=1.00 (REF) p=0.0107	21	n=330 d=91	**0: 38.59%** **1: 20.51%**	--

Model	Variable(s) in model	Physical Component Summary Score (PCS) HR (95% CI)	Difference in 'N'	Total in model (n) and total dead (d)	% change from Crude	% change from model 1
13	Model 1 + Tamoxifen Use	0: HR=2.21 (1.24-3.95) 1: HR=1.23 (0.66-2.29) 2: HR=1.00 (REF) p=0.0079	21	n=330 d=91	**0: 37.75%** **1: 21.15%**	0: 1.38% 1: 0.81%
14	Model 1 + Smoking Status	0: HR=2.13 (1.20-3.81) 1: HR=1.22 (0.65-2.29) 2: HR=1.00 (REF) p=0.0128	21	n=330 d=91	**0: 40.00%** **1: 21.79%**	0: 2.29% 1: 1.61%
15	Model 1 + Physical Activity	0: HR=2.13 (1.18-3.82) 1: HR=1.22 (0.65-2.28) 2: HR=1.00 (REF) p=0.0143	21	n=330 d=91	**0: 40.00%** **1: 21.79%**	0: 2.29% 1: 1.61%
Subset--Restricted to participants with BMI variable						
Crude	Physical Component Summary Score (PCS)	0: HR=3.48 (1.94-6.24) 1: HR=1.71 (0.90-3.24) 2: HR=1.00 (REF) p=<0.0001	27	n=324 d=85	--	--

Model	Variable(s) in model	Physical Component Summary Score (PCS) HR (95% CI)	Difference in 'N'	Total in model (n) and total dead (d)	% change from Crude	% change from model 1
1	Age, Marital Status, & Tumor Stage	0: HR=2.19 (1.19-4.04) 1: HR=1.44 (0.75-2.76) 2: HR=1.00 (REF) p=0.0300	27	n=324 d=85	**0: 37.07%** **1:15.79%**	--
16	Model 1 + BMI	0: HR=2.17 (1.16-4.07) 1: HR=1.45 (0.75-2.78) 2: HR=1.00 (REF) p=0.0402	27	n=324 d=85	**0: 37.64%** **1: 15.20%**	0: 0.91% 1: 0.69%
Subset--Restricted to participants with Tumor Subtype variable						
Crude	Physical Component Summary Score (PCS)	0: HR=3.37 (1.88-6.04) 1: HR=1.79 (0.95-3.38) 2: HR=1.00 (REF) p=<0.0001	51	n=300 d=87	--	--
1	Age, Marital Status, & Tumor Stage	0: HR=2.11 (1.15-3.89) 1: HR=1.46 (0.76-2.77) 2: HR=1.00 (REF) p=0.0435	51	n=300 d=87	**0: 37.39%** **1: 18.44%**	--

Model	Variable(s) in model	Physical Component Summary Score (PCS) HR (95% CI)	Difference in 'N'	Total in model (n) and total dead (d)	% change from Crude	% change from model 1
17	Model 1 + Tumor Subtype	0: HR=2.14 (1.16-3.95) 1: HR=1.45 (0.76-2.77) 2: HR=1.00 (REF) p=0.0371	51	n=300 d=87	**0: 36.50%** **1: 18.99%**	0: 1.42% 1: 0.68%
*Model 1 is considered the 'base' for adjustment when PCS is the predictor.						

Appendix D. Multivariable Modeling with Physical Component Summary Score as the Predictor and All-Cause Mortality as the Outcome (*N* = 351)

Model	Variable(s) in model	Physical Component Summary Score (PCS) HR (95% CI)	Difference in 'N'	Total in model (n) and total dead (d)	% change from Crude	% change from model 1	% change from previous model
Crude	Physical Component Summary Score (PCS)	0: HR=3.80 (2.20-6.54) 1: HR=1.67 (0.91-3.07) 2: HR=1.00 (REF) p=<0.0001	0	n=351 d=99	--	--	--
1	Age, Marital Status, & Tumor Stage	0: HR=2.32 (1.29-4.11) 1: HR=1.34 (0.72-2.47) 2: HR=1.00 (REF) p=0.0052	0	n=351 d=99	**0: 38.95%** **1: 19.76%**	--	--
2	Model 1 + Race/Ethnicity	0: HR=2.34 (1.32-4.15) 1: HR=1.34 (0.72-2.48) 2: HR=1.00 (REF) p=0.0048	0	n=351 d=99	**0: 38.42%** **1: 19.76%**	0: 0.86% 1: 0.00%	--
3	Model 1 + Race/Ethnicity + Treatment Type	0: HR=2.26 (1.27-4.00) 1: HR=1.29 (0.70-2.40) 2: HR=1.00 (REF) p=0.0062	0	n=351 d=99	**0: 40.53%** **1: 22.75%**	0: 2.59% 1: 3.73%	0: 3.42% 1: 3.73%
4	Model 1 + Race/Ethnicity + Treatment Type + Comorbidities	0: HR=2.12 (1.18-3.81) 1: HR=1.26 (0.68-2.35) 2: HR=1.00 (REF) p=0.0152	0	n=351 d=99	**0: 44.21%** **1: 24.55%**	0: 8.62% 1: 5.97%	0: 6.19% 1: 2.33%

Model	Variable(s) in model	Physical Component Summary Score (PCS) HR (95% CI)	Difference in 'N'	Total in model (n) and total dead (d)	% change from Crude	% change from model 1	% change from previous model
5	Model 1 + Race/Ethnicity + Treatment Type + Comorbidities + Current Lymphedema	0: HR=2.26 (1.26-4.06) 1: HR=1.31 (0.70-2.44) 2: HR=1.00 (REF) p=0.0086	0	n=351 d=99	**0: 40.53%** **1: 21.56%**	0: 2.59% 1: 2.24%	0: 6.60% 1: 3.97%
6	Model 1 + Race/Ethnicity + Treatment Type + Comorbidities + Current Lymphedema + Pessimism	0: HR=2.14 (1.19-3.85) 1: HR=1.34 (0.72-2.48) 2: HR=1.00 (REF) p=0.0205	0	n=351 d=99	**0: 43.68%** **1: 19.76%**	0: 7.76% 1: 0.00%	0: 5.31% 1: 2.29%
7	Model 1 + Race/Ethnicity + Treatment Type + Comorbidities + Current Lymphedema + Pessimism + Number of Types of Confidants (Confide)	0: HR=2.17 (1.21-3.90) 1: HR=1.36 (0.73-2.54) 2: HR=1.00 (REF) p=0.0201	0	n=351 d=99	**0: 42.89%** **1: 18.56%**	0: 6.47% 1: 1.49%	0: 1.40% 1: 1.49%
8	Model 1 + Race/Ethnicity + Treatment Type + Comorbidities + Current Lymphedema + Pessimism + Confide + Fear of Recurrence	0: HR=2.17 (1.20-3.90) 1: HR=1.37 (0.74-2.56) 2: HR=1.00 (REF) p=0.0209	0	n=351 d=99	**0: 17.96%** **1: 21.56%**	0: 6.47% 1: 2.24%	0: 0.00% 1: 0.74%
Subset--Restricted to participants with Education variable							
Crude	Physical Component Summary Score (PCS)	0: HR=3.74 (2.17-6.45) 1: HR=1.67 (0.91-3.07) 2: HR=1.00 (REF) p=<0.0001	1	n=350 d=98	--	--	--

Model	Variable(s) in model	Physical Component Summary Score (PCS) HR (95% CI)	Difference in 'N'	Total in model (n) and total dead (d)	% change from Crude	% change from model 1	% change from previous model
1	Age, Marital Status, & Tumor Stage	0: HR=2.30 (1.29-4.07) 1: HR=1.33 (0.72-2.47) 2: HR=1.00 (REF) p=0.0063	1	n=350 d=98	**0: 38.50%** **1: 20.36%**	--	--
9	Model 1 + Education	0: HR=2.26 (1.28-4.02) 1: HR=1.31 (0.71-2.43) 2: HR=1.00 (REF) p=0.0076	1	n=350 d=98	**0: 39.57%** **1: 21.56%**	0: 1.74% 1: 1.50%	--
10	Model 1 + Education + Race/Ethnicity	0: HR=2.27 (1.28-4.04) 1: HR=1.31 (0.71-2.43) 2: HR=1.00 (REF) p=0.0071	1	n=350 d=98	**0: 39.30%** **1: 21.56%**	0: 1.30% 1: 1.50%	0: 0.44% 1: 0.00%
11	Model 1 + Education + Race/Ethnicity + Treatment Type	0: HR=2.18 (1.23-3.87) 1: HR=1.28 (0.69-2.37) 2: HR=1.00 (REF) p=0.0100	1	n=350 d=98	**0: 41.71%** **1: 23.35%**	0: 5.22% 1: 3.76%	0: 3.96% 1: 2.29%
12	Model 1 + Education + Race/Ethnicity + Treatment Type + Comorbidities	0: HR=2.08 (1.16-3.72) 1: HR=1.25 (0.67-2.32) 2: HR=1.00 (REF) p=0.0204	1	n=350 d=98	**0: 44.39%** **1: 25.15%**	0: 9.57% 1: 6.02%	0: 4.59% 1: 2.34%

Model	Variable(s) in model	Physical Component Summary Score (PCS) HR (95% CI)	Difference in 'N'	Total in model (n) and total dead (d)	% change from Crude	% change from model 1	% change from previous model
13	Model 1 + Education + Race/Ethnicity + Treatment Type + Comorbidities + Current Lymphedema	0: HR=2.21 (1.23-3.97) 1: HR=1.30 (0.70-2.42) 2: HR=1.00 (REF) p=0.0119	1	n=350 d=98	**0: 40.91%** **1: 22.16%**	0: 3.91% 1: 2.26%	0: 6.25% 1: 4.00%
14	Model 1 + Education + Race/Ethnicity + Treatment Type + Comorbidities + Current Lymphedema + Pessimism	0: HR=2.09 (1.16-3.75) 1: HR=1.34 (0.72-2.49) 2: HR=1.00 (REF) p=0.0296	1	n=350 d=98	**0: 44.12%** **1: 19.76%**	0: 9.13% 1: 0.75%	0: 5.43% 1: 3.08%
15	Model 1 + Education + Race/Ethnicity + Treatment Type + Comorbidities + Current Lymphedema + Pessimism + Confide	0: HR=2.11 (1.17-3.80) 1: HR=1.37 (0.73-2.54) 2: HR=1.00 (REF) p=0.0289	1	n=350 d=98	**0: 43.58%** **1: 17.96%**	0: 8.26% 1: 3.01%	0: 0.96% 1: 2.24%
16	Model 1 + Education + Race/Ethnicity + Treatment Type + Comorbidities + Current Lymphedema + Pessimism + Confide + Fear of Recurrence	0: HR=2.11 (1.18-3.80) 1: HR=1.38 (0.74-2.57) 2: HR=1.00 (REF) p=0.0293	1	n=350 d=98	**0: 43.58%** **1: 17.37%**	0: 8.26% 1: 3.76%	0: 0.00% 1: 0.73%
Subset--Restricted to participants with Lymph Node Involvement variable							
Crude	Physical Component Summary Score (PCS)	0: HR=3.96 (2.26-6.94) 1: HR=1.63 (0.87-3.07) 2: HR=1.00 (REF) p=<0.0001	10	n=341 d=92	--	--	--

Model	Variable(s) in model	Physical Component Summary Score (PCS) HR (95% CI)	Difference in 'N'	Total in model (n) and total dead (d)	% change from Crude	% change from model 1	% change from previous model
1	Age, Marital Status, & Tumor Stage	0: HR=2.36 (1.30-4.25) 1: HR=1.35 (0.71-2.56) 2: HR=1.00 (REF) p=0.0071	10	n=341 d=92	**0: 40.40%** **1: 17.18%**	--	--
17	Model 1 + Lymph Node Involvement (LNI)	0: HR=2.34 (1.30-4.24) 1: HR=1.34 (0.71-2.55) 2: HR=1.00 (REF) p=0.0076	10	n=341 d=92	**0: 40.91%** **1: 17.79%**	0: 0.85% 1: 0.74%	--
18	Model 1 + LNI + Race/Ethnicity	0: HR=2.36 (1.31-4.28) 1: HR=1.35 (0.71-2.56) 2: HR=1.00 (REF) p=0.0070	10	n=341 d=92	**0: 40.40%** **1: 17.18%**	0: 0.00% 1: 0.00%	0: 0.85% 1: 0.75%
19	Model 1 + LNI + Race/Ethnicity + Treatment Type	0: HR=2.28 (1.26-4.13) 1: HR=1.33 (0.70-2.52) 2: HR=1.00 (REF) p=0.0102	10	n=341 d=92	**0: 42.42%** **1: 18.40%**	0: 3.39% 1: 1.48%	0: 3.39% 1: 1.48%
20	Model 1 + LNI + Race/Ethnicity + Treatment Type + Comorbidities	0: HR=2.19 (1.20-4.01) 1: HR=1.30 (0.68-2.48) 2: HR=1.00 (REF) p=0.0174	10	n=341 d=92	**0: 44.70%** **1: 20.25%**	0: 7.20% 1: 3.70%	0: 3.95% 1: 2.26%

Model	Variable(s) in model	Physical Component Summary Score (PCS) HR (95% CI)	Difference in 'N'	Total in model (n) and total dead (d)	% change from Crude	% change from model 1	% change from previous model
21	Model 1 + LNI + Race/Ethnicity + Treatment Type + Comorbidities + Current Lymphedema	0: HR=2.32 (1.27-4.26) 1: HR=1.35 (0.71-2.58) 2: HR=1.00 (REF) p=0.0109	10	n=341 d=92	**0: 41.41%** **1: 17.18%**	0: 1.69% 1: 0.00%	0: 5.94% 1: 3.85%
22	Model 1 + LNI + Race/Ethnicity + Treatment Type + Comorbidities + Current Lymphedema + Pessimism	0: HR=2.20 (1.20-4.04) 1: HR=1.37 (0.72-2.61) 2: HR=1.00 (REF) p=0.0222	10	n=341 d=92	**0: 44.44%** **1: 15.95%**	0: 6.78% 1: 1.48%	0: 5.17% 1: 1.48%
23	Model 1 + LNI + Race/Ethnicity + Treatment Type + Comorbidities + Current Lymphedema + Pessimism + Confide	0: HR=2.24 (1.22-4.11) 1: HR=1.40 (0.74-2.68) 2: HR=1.00 (REF) p=0.0206	10	n=341 d=92	**0: 43.43%** **1: 14.11%**	0: 5.08% 1: 3.70%	0: 1.82% 1: 2.19%
24	Model 1 + LNI + Race/Ethnicity + Treatment Type + Comorbidities + Current Lymphedema + Pessimism + Confide + Fear of Recurrence	0: HR=2.25 (1.23-4.11) 1: HR=1.42 (0.74-2.70) 2: HR=1.00 (REF) p=0.0207	10	n=341 d=92	**0: 43.18%** **1: 12.88%**	0: 4.66% 1: 5.19%	0: 0.45% 1: 1.43%
Subset--Restricted to participants with Education and LNI variables (24-month follow-up)							
Crude	Physical Component Summary Score (PCS)	0: HR=3.90 (2.22-6.84) 1: HR=1.63 (0.87-3.07) 2: HR=1.00 (REF) p=<0.0001	11	n=340 d=91	--	--	--

Model	Variable(s) in model	Physical Component Summary Score (PCS) HR (95% CI)	Difference in 'N'	Total in model (n) and total dead (d)	% change from Crude	% change from model 1	% change from previous model
1	Age, Marital Status, & Tumor Stage	0: HR=2.33 (1.29-4.21) 1: HR=1.35 (0.71-2.56) 2: HR=1.00 (REF) p=0.0085	11	n=340 d=91	**0: 40.26%** **1: 17.18%**	--	--
25	Model 1 + Education + LNI	0: HR=2.31 (1.27-4.18) 1: HR=1.31 (0.69-2.49) 2: HR=1.00 (REF) p=0.0093	11	n=340 d=91	**0: 40.77%** **1: 19.63%**	0: 0.86% 1: 2.96%	--
26	Model 1 Education + LNI + Race/Ethnicity	0: HR=2.32 (1.28-4.20) 1: HR=1.32 (0.69-2.50) 2: HR=1.00 (REF) p=0.0086	11	n=340 d=91	**0: 40.51%** **1: 19.02%**	0: 0.43% 1: 2.22%	0: 0.43% 1: 0.76%
27	Model 1 + Education + LNI + Race/Ethnicity + Treatment Type	0: HR=2.23 (1.23-4.04) 1: HR=1.30 (0.69-2.47) 2: HR=1.00 (REF) p=0.0129	11	n=340 d=91	**0: 42.82%** **1: 20.25%**	0: 4.29% 1: 3.70%	0: 3.88% 1: 1.52%
28	Model 1 + Education + LNI + Race/Ethnicity + Treatment Type + Comorbidities	0: HR=2.16 (1.18-3.95) 1: HR=1.28 (0.67-2.43) 2: HR=1.00 (REF) p=0.0202	11	n=340 d=91	**0: 44.62%** **1: 21.47%**	0: 7.30% 1: 5.19%	0: 7.30% 1: 1.54%

Model	Variable(s) in model	Physical Component Summary Score (PCS) HR (95% CI)	Difference in 'N'	Total in model (n) and total dead (d)	% change from Crude	% change from model 1	% change from previous model
29	Model 1 + Education + LNI + Race/Ethnicity + Treatment Type + Comorbidities + Current Lymphedema	0: HR=2.29 (1.25-4.20) 1: HR=1.34 (0.70-2.55) 2: HR=1.00 (REF) p=0.0128	11	n=340 d=91	**0: 41.28%** **1: 17.79%**	0: 1.72% 1: 0.74%	0: 6.02% 1: 4.69%
30	Model 1 + Education + LNI + Race/Ethnicity + Treatment Type + Comorbidities + Current Lymphedema + Pessimism	0: HR=2.16 (1.18-3.95) 1: HR=1.37 (0.72-2.61) 2: HR=1.00 (REF) p=0.0298	11	n=340 d=91	**0: 44.62%** **1: 15.95%**	0: 7.30% 1: 1.48%	0: 5.68% 1: 2.24%
31	Model 1 + Education + LNI + Race/Ethnicity + Treatment Type + Comorbidities + Current Lymphedema + Pessimism + Confide	0: HR=2.19 (1.20-4.02) 1: HR=1.40 (0.74-2.68) 2: HR=1.00 (REF) p=0.0274	11	n=340 d=91	**0: 43.85%** **1: 14.11%**	0: 6.01% 1: 3.70%	0: 0.44% 1: 2.19%
32	Model 1 + Education + LNI + Race/Ethnicity + Treatment Type + Comorbidities + Current Lymphedema + Pessimism + Confide + Fear of Recurrence	0: HR=2.21 (1.20-4.05) 1: HR=1.42 (0.74-2.72) 2: HR=1.00 (REF) p=0.0268	11	n=340 d=91	**0: 43.33%** **1: 12.88%**	0: 5.15% 1: 5.19%	0: 0.91% 1: 1.43%
Subset--Restricted to participants with Physical Activity variable (24-month follow-up)							
Crude	Physical Component Summary Score (PCS)	0: HR=3.55 (2.04-6.17) 1: HR=1.56 (0.84-2.90) 2: HR=1.00 (REF) p=<0.0001	21	n=330 d=91	--	--	--

Model	Variable(s) in model	Physical Component Summary Score (PCS) HR (95% CI)	Difference in 'N'	Total in model (n) and total dead (d)	% change from Crude	% change from model 1	% change from previous model
1	Age, Marital Status, & Tumor Stage	0: HR=2.18 (1.22-3.91) 1: HR=1.24 (0.66-2.33) 2: HR=1.00 (REF) p=0.0107	21	n=330 d=91	**0: 38.59%** **1: 20.51%**	--	--
33	Model 1 + Physical Activity	0: HR=2.13 (1.18-3.82) 1: HR=1.22 (0.65-2.28) 2: HR=1.00 (REF) p=0.0143	21	n=330 d=91	**0: 40.00%** **1: 21.79%**	0: 2.29% 1: 1.61%	--
34	Model 1 + Physical Activity + Race/Ethnicity	0: HR=2.14 (1.19-3.85) 1: HR=1.21 (0.65-2.27) 2: HR=1.00 (REF) p=0.0130	21	n=330 d=91	**0: 39.72%** **1: 22.44%**	0: 1.83% 1: 2.42%	0: 0.47% 1: 0.82%
35	Model 1 + Physical Activity + Race/Ethnicity + Treatment Type	0: HR=2.03 (1.13-3.64) 1: HR=1.19 (0.63-2.22) 2: HR=1.00 (REF) p=0.0224	21	n=330 d=91	**0: 42.82%** **1: 23.72%**	0: 6.88% 1: 4.03%	0: 5.14% 1: 1.65%
36	Model 1 + Physical Activity + Race/Ethnicity + Treatment Type + Comorbidities	0: HR=1.90 (1.04-3.45) 1: HR=1.17 (0.62-2.20) 2: HR=1.00 (REF) p=0.0549	21	n=330 d=91	**0: 46.48%** **1: 25.00%**	**0: 12.84%** 1: 5.65%	0: 6.40% 1: 1.68%

Model	Variable(s) in model	Physical Component Summary Score (PCS) HR (95% CI)	Difference in 'N'	Total in model (n) and total dead (d)	% change from Crude	% change from model 1	% change from previous model
37	Model 1 + Physical Activity + Race/Ethnicity + Treatment Type + Comorbidities + Current Lymphedema	0: HR=2.00 (1.09-3.64) 1: HR=1.21 (0.65-2.28) 2: HR=1.00 (REF) p=0.0386	21	n=330 d=91	**0: 43.66%** **1: 22.44%**	0: 8.26% 1: 2.42%	0: 5.26% 1: 3.42%
38	Model 1 + Physical Activity + Race/Ethnicity + Treatment Type + Comorbidities + Current Lymphedema + Pessimism	0: HR=1.96 (1.08-3.57) 1: HR=1.24 (0.66-2.32) 2: HR=1.00 (REF) p=0.0523	21	n=330 d=91	**0: 44.79%** **1: 20.51%**	**0: 10.09%** 1: 0.00%	0: 2.00% 1: 2.48%
39	Model 1 + Physical Activity + Race/Ethnicity + Treatment Type + Comorbidities + Current Lymphedema + Pessimism + Confide	0: HR=1.98 (1.08-4.08) 1: HR=1.26 (0.67-2.36) 2: HR=1.00 (REF) p=0.0521	21	n=330 d=91	**0: 44.23%** **1: 19.23%**	0: 9.17% 1: 1.61%	0: 1.02% 1: 1.61%
40	Model 1 + Physical Activity + Race/Ethnicity + Treatment Type + Comorbidities + Current Lymphedema + Pessimism + Confide + Fear of Recurrence	0: HR=1.98 (1.08-3.63) 1: HR=1.26 (0.67-2.36) 2: HR=1.00 (REF) p=0.0521	21	n=330 d=91	**0: 44.23%** **1: 19.23%**	0: 9.17% 1: 1.61%	0: 0.00% 1: 0.00%
Subset--Restricted to participants with Education, LNI, and Physical Activity variables							
Crude	Physical Component Summary Score (PCS)	0: HR=3.62 (2.05-6.41) 1: HR=1.51 (0.79-2.87) 2: HR=1.00 (REF) p=<0.0001	32	n=319 d=83	--	--	--

Model	Variable(s) in model	Physical Component Summary Score (PCS) HR (95% CI)	Difference in 'N'	Total in model (n) and total dead (d)	% change from Crude	% change from model 1	% change from previous model
1	Age, Marital Status, & Tumor Stage	0: HR=2.17 (1.19-3.98) 1: HR=1.25 (0.65-2.40) 2: HR=1.00 (REF) p=0.0186	32	n=319 d=83	**0: 40.06%** **1: 17.22%**	--	--
41	Model 1 + Education + LNI + Physical Activity	0: HR=2.13 (1.15-3.93) 1: HR=1.23 (0.64-2.36) 2: HR=1.00 (REF) p=0.0258	32	n=319 d=83	**0: 41.16%** **1: 18.54%**	0: 1.84% 1: 1.60%	--
42	Model 1 + Education + LNI + Physical Activity + Race/Ethnicity	0: HR=2.14 (1.16-3.95) 1: HR=1.23 (0.64-2.35) 2: HR=1.00 (REF) p=0.0241	32	n=319 d=83	**0: 40.88%** **1: 18.54%**	0: 1.38% 1: 1.60%	0: 0.47% 1: 0.00%
43	Model 1 + Education + LNI + Physical Activity + Race/Ethnicity + Treatment Type	0: HR=2.01 (1.09-3.71) 1: HR=1.22 (0.64-2.34) 2: HR=1.00 (REF) p=0.0444	32	n=319 d=83	**0: 44.48%** **1: 19.21%**	0: 7.37% 1: 2.40%	0: 6.07% 1: 0.81%
44	Model 1 + Education + LNI + Physical Activity + Race/Ethnicity + Treatment Type + Comorbidities	0: HR=1.93 (1.04-3.61) 1: HR=1.21 (0.63-2.32) 2: HR=1.00 (REF) p=0.0707	32	n=319 d=83	**0: 46.69%** **1: 19.87%**	**0: 11.06%** 1: 3.20%	0: 3.98% 1: 0.82%

Model	Variable(s) in model	Physical Component Summary Score (PCS) HR (95% CI)	Difference in 'N'	Total in model (n) and total dead (d)	% change from Crude	% change from model 1	% change from previous model
45	Model 1 + Education + LNI + Physical Activity + Race/Ethnicity + Treatment Type + Comorbidities + Current Lymphedema	0: HR=2.05 (1.09-3.83) 1: HR=1.26 (0.65-2.42) 2: HR=1.00 (REF) p=0.0504	32	n=319 d=83	**0: 43.37%** **1: 16.56%**	0: 5.53% 1: 0.80%	0: 6.22% 1: 4.13%
46	Model 1 + Education + LNI + Physical Activity + Race/Ethnicity + Treatment Type + Comorbidities + Current Lymphedema + Pessimism	0: HR=2.00 (1.07-3.74) 1: HR=1.29 (0.67-2.48) 2: HR=1.00 (REF) p=0.0666	32	n=319 d=83	**0: 44.75%** **1: 14.57%**	0: 7.83% 1: 3.20%	0: 2.44% 1: 2.38%
47	Model 1 + Education + LNI + Physical Activity + Race/Ethnicity + Treatment Type + Comorbidities + Current Lymphedema + Pessimism + Confide	0: HR=2.05 (1.09-3.85) 1: HR=1.31 (0.68-2.54) 2: HR=1.00 (REF) p=0.0617	32	n=319 d=83	**0: 43.37%** **1: 13.25%**	0: 5.53% 1: 4.80%	0: 2.50% 1: 1.55%
48	Model 1 + Education + LNI + Physical Activity + Race/Ethnicity + Treatment Type + Comorbidities + Current Lymphedema + Pessimism + Confide + Fear of Recurrence	0: HR=2.05 (1.09-3.86) 1: HR=1.32 (0.68-2.56) 2: HR=1.00 (REF) p=0.0622	32	n=319 d=83	**0: 43.37%** **1: 12.58%**	0: 5.53% 1: 5.60%	0: 0.00% 1: 0.76%

Appendix E. Mental Component Summary Score Univariate HR Analysis and Percent Change for All-Cause Mortality when Assessing for Potential Confounders (*N* = 351)

Model	Variable(s) in model	Categories	Total in categories (n)	Total in model (n); dead (d)	Missing	Univariate-Cox HR (95% CI)	p-values*	MCS HR (95% CI) and p-values	% change from crude model
Crude	Mental Component Summary Score (MCS)	0: ≤ 45.12 1: > 45.12 & ≤ 54.40 2: > 54.40 (REF)	0: 117 1: 117 2: 117	n=351 d=99	0	0: HR=1.36 (0.83-2.23) 1: HR=1.25 (0.76-2.06)	p=0.4590	0: HR=1.36 (0.83-2.23) p(MCS)=0.4590 1: HR=1.25 (0.76-2.06) p(MCS)=0.3760	--
1	Age	Continuous	--	n=351 d=99	0	HR=1.07 (1.05-1.09)	**p=<0.0001**	0: HR=1.66 (1.01-2.72) p(MCS)=0.0461 1: HR=1.34 (0.81-2.20) p(MCS)=0.2496 p(Age)=<0.0001	**0: 22.06%** **1: 7.20%**
2	Race/Ethnicity	0: Non-Hispanic White (REF) 1: Hispanic	0: 273 1: 78	n=351 d=99	0	0: HR=1.00 1: HR=0.64 (0.37-1.09)	**p=0.1015**	0: HR=1.41 (0.86-2.32) p(MCS)=0.1720 1: HR=1.28 (0.78-2.11) p(MCS)=0.3275 p(Ethnicity)=0.1015	0: 3.68% 1: 2.40%
3	Marital Status	0: Single 1: Married (REF)	0: 160 1: 191	n=351 d=99	0	0: HR=1.99 (1.33-2.98) 1: HR=1.00	**p=0.0008**	0: HR=1.35 (0.83-2.22) p(MCS)=0.2290 1: HR=1.29 (0.78-2.12) p(MCS)=0.3201 p(Marital)=0.0008	0: 0.74% 1: 3.20%

Model	Variable(s) in model	Categories	Total in categories (n)	Total in model (n); dead (d)	Missing	Univariate-Cox HR (95% CI)	p-values*	MCS HR (95% CI) and p-values	% change from crude model
4	Tumor Stage	0: Localized (I) 1: Regional (II-IIIa)	0: 276 1: 75	n=351 d=99	0	0: HR=1.00 1: HR=1.20 (0.76-1.90)	p=0.4442	0: HR=1.38 (0.84-2.26) p(MCS)=0.2050 1: HR=1.26 (0.76-2.07) p(MCS)=0.3682 p(Stage)=0.4442	0: 1.47% 1: 0.80%
5	Breast Cancer Treatment Type	0: Surgery only (REF) 1: Any chemotherapy 2: Surgery and radiation	0: 98 1: 109 2: 144	n=351 d=99	0	0: HR=1.00 1: HR=0.69 (0.42-1.14) 2: HR=0.69 (0.43-1.10)	**p=0.2202**	0: HR=1.37 (0.84-2.25) p(MCS)=0.2111 1: HR=1.25 (0.76-2.06) p(MCS)=0.3777 p(Treatment1)=0.1492 p(Treatment2)=0.1211	0: 0.74% 1: 0.00%
6	Comorbidities	0: Zero (REF) 1: One or more	0: 298 1: 53	n=351 d=99	0	0: HR=1.00 1: HR=1.96 (1.22-3.14)	**p=0.0056**	0: HR=1.25 (0.76-2.05) p(MCS)=0.3898 1: HR=1.23 (0.75-2.03) p(MCS)=0.4095 p(Comorbidities)=0.0056	0: 8.09% 1: 1.60%
7	Current Lymphedema	0: No (REF) 1: Yes	0: 307 1: 44	n=351 d=99	0	0: HR=1.00 1: HR=0.61 (0.31-1.21)	**p=0.1586**	0: HR=1.43 (0.87-2.35) p(MCS)=0.1612 1: HR=1.27 (0.77-2.09) p(MCS)=0.3417 p(Lymphedema)=0.0524	0: 5.15% 1: 1.57%

Model	Variable(s) in model	Categories	Total in categories (n)	Total in model (n); dead (d)	Missing	Univariate-Cox HR (95% CI)	p-values*	MCS HR (95% CI) and p-values	% change from crude model
8	Perceived Optimism	0: ≤ 10 1: > 10 (REF)	0: 83 1: 268	n=351 d=99	0	0: HR=1.51 (0.99-2.41) 1: HR=1.00	**p=0.0519**	0: HR=1.20 (0.72-2.00) p(MCS)=0.4913 1: HR=1.17 (0.71-1.94) p(MCS)=0.5348 p(Optimism)=0.0519	**0: 11.76%** 1: 6.40%
9	Perceived Pessimism	0: ≤ 10 (REF) 1: > 10	0: 255 1: 96	n=351 d=99	0	0: HR=1.00 1: HR=1.69 (1.10-2.58)	**p=0.0146**	0: HR=1.19 (0.71-1.97) p(MCS)=0.5096 1: HR=1.17 (0.71-1.94) p(MCS)=0.5330 p(Pessimism)=0.0146	**0: 12.50%** 1: 6.40%
10	Current Fatigue	0: No (REF) 1: Yes	0: 136 1: 215	n=351 d=99	0	0: HR=1.00 1: HR=0.86 (0.55-1.35)	p=0.5080	0: HR=1.47 (0.85-2.54) p(MCS)=0.1664 1: HR=1.29 (0.78-2.14) p(MCS)=0.3237 p(Fatigue)=0.5080	0: 8.09% 1: 3.20%
11	Fear of Recurrence	0: No (REF) 1: Yes	0: 154 1: 197	n=351 d=99	0	0: HR=1.00 1: HR=0.64 (0.43-0.96)	**p=0.0313**	0: HR=1.49 (0.90-2.46) p(MCS)=0.1177 1: HR=1.34 (0.81-2.21) p(MCS)=0.2528 p(Fear)=0.0313	0: 9.56% 1: 7.20%

Model	Variable(s) in model	Categories	Total in categories (n)	Total in model (n); dead (d)	Missing	Univariate-Cox HR (95% CI)	p-values*	MCS HR (95% CI) and p-values	% change from crude model
12	Number of Types of Confidants	0: < 3 1: 4-5 2: > 5 (REF)	0: 66 1: 172 2: 113	n=351 d=99	0	0: HR=1.76 (1.01-3.04) 1: HR=1.23 (0.76-1.98) 2: HR=1.00	**p=0.1241**	0: HR=1.35 (0.82-2.22) p(MCS)=0.2328 1: HR=1.26 (0.76-2.06) p(MCS)=0.3710 p(Confidant0)=0.0444 p(Confidant1)=0.4031	0: 0.74% 1: 0.80%
13	Bodily Pain	0: No Pain 1: Experienced Pain (REF)	0: 180 1: 171	n=351 d=99	0	0: HR=1.00 1: HR=1.60 (0.96-2.67)	**p=0.0746**	0: HR=0.84 (0.36-1.96) p(MCS)=0.6864 1: HR=0.95 (0.49-1.84) p(MCS)=0.8795 p(Pain)=0.0746	**0: 38.24%** **1: 24.00%**
14	Perceived General Health	0: "Poor" & "Fair" 1: "Good", "Very Good", & "Excellent" (REF)	0: 54 1: 297	n=351 d=99	0	0: HR=2.43 (1.53-3.85) 1: HR=1.00	**p=0.0002**	0: HR=1.08 (0.64-1.80) p(MCS)=0.7809 1: HR=1.21 (0.73-1.98) p(MCS)=0.4627 p(Health)=0.0797	**0: 20.59%** 1: 3.20%
Crude	MCS (restricted to those with education)		0: 117 1: 116 2: 117	n=350 d=98		0: HR=1.36 (0.83-2.23) 1: HR=1.22 (0.74-2.01)	p=0.4697	0: HR=1.36 (0.83-2.23) p(MCS)=0.2210 1: HR=1.22 (0.74-2.01) p(MCS)=0.4374	--

Model	Variable(s) in model	Categories	Total in categories (n)	Total in model (n); dead (d)	Missing	Univariate-Cox HR (95% CI)	p-values*	MCS HR (95% CI) and p-values	% change from crude model
15	Education	0: High school or less 1: Some college 2: College graduate 3: Graduate school (REF)	0: 92 1: 114 2: 70 3: 74	n=350 d=98	1	0: HR=1.88 (1.03-3.45) 1: HR=1.55 (0.86-2.78) 2: HR=0.87 (0.42-1.81) 3: HR=1.00	**p=0.0504**	0: HR=1.33 (0.81-2.19) p(MCS)=0.2554 1: HR=1.27 (0.77-2.11) p(MCS)=0.3461 p(Education0)=0.0408 p(Education1)=0.1415 p(Education2)=0.7046	0: 2.21% 1: 4.10%
Crude	MCS (restricted to those with tumor size)		0: 113 1: 114 2: 114	n=341 d=99		0: HR=1.38 (0.84-2.27) 1: HR=1.26 (0.78-2.07)	p=0.4244	0: HR=1.38 (0.84-2.27) p(MCS)=0.1979 1: HR=1.26 (0.78-2.07) p(MCS)=0.3593	--
16	Tumor Size	0: < 3 cm (REF) 1: ≥ 3 cm	0: 304 1: 37	n=341 d=99	10	0: HR=1.00 1: HR=1.21 (0.66-2.21)	p=0.5424	0: HR=1.38 (0.84-2.26) p(MCS)=0.2021 1: HR=1.27 (0.77-2.08) p(MCS)=0.3527 p(Size)=0.5424	0: 0.00% 1: 0.79%
Crude	MCS (restricted to those with lymph node involvement)		0: 112 1: 114 2: 115	n=341 d=92		0: HR=1.18 (0.71-1.96) 1: HR=1.19 (0.72-1.97)	p=0.7579	0: HR=1.18 (0.71-1.96) p(MCS)=0.5337 1: HR=1.19 (0.72-1.97) p(MCS)=0.4980	--

Model	Variable(s) in model	Categories	Total in categories (n)	Total in model (n); dead (d)	Missing	Univariate-Cox HR (95% CI)	p-values*	MCS HR (95% CI) and p-values	% change from crude model
17	Lymph Node Involvement	0: None (REF) 1: ≥ 1 lymph node involved	0: 264 1: 77	n=341 d=92	10	0: HR=1.00 1: HR=1.25 (0.78-1.99)	p=0.3564	0: HR=1.19 (0.71-1.99) p(MCS)=0.5050 1: HR=1.19 (0.72-1.98) p(MCS)=0.4916 p(Lymph node)=0.3564	0: 0.85% 1: 0.00%
Crude	MCS (restricted to those with Tamoxifen use, smoking status, and physical activity)		0: 110 1: 109 2: 111	n=330 d=91		0: HR=1.42 (0.85-2.36) 1: HR=1.21 (0.72-2.03)	p=0.4106	0: HR=1.42 (0.85-2.36) p(MCS)=0.1824 1: HR=1.21 (0.72-2.03) p(MCS)=0.4824	--
18	Tamoxifen Use	0: No 1: Yes (REF)	0: 160 1: 170	n=330 d=91	21	0: HR=1.13 (0.75-1.70) 1: HR=1.00	p=0.5755	0: HR=1.41 (0.84-2.35) p(MCS)=0.1916 1: HR=1.19 (0.71-2.01) p(MCS)=0.5088 p(Tamoxifen)=0.5755	0: 0.70% 1: 1.65%
19	Smoking Status	0: Never (REF) 1: Former 2: Current	0: 145 1: 144 2: 41	n=330 d=91	21	0: HR=1.00 1: HR=0.98 (0.62-1.51) 2: HR=1.27 (0.68-2.40)	p=0.6859	0: HR=1.39 (0.83-2.33) p(MCS)=0.2090 1: HR=1.20 (0.71-2.03) p(MCS)=0.1671 p(Smoker1)=0.8821 p(Smoker2)=0.4551	0: 2.11% 1: 0.83%

Model	Variable(s) in model	Categories	Total in categories (n)	Total in model (n); dead (d)	Missing	Univariate-Cox HR (95% CI)	p-values*	MCS HR (95% CI) and p-values	% change from crude model
20	Physical Activity	0: None 1: Low 2: Moderate/Vigorous (REF)	0: 185 1: 59 2: 86	n=330 d=91	21	0: HR=1.99 (1.16-3.41) 1: HR=1.05 (0.50-2.19) 2: HR=1.00	**p=0.0132**	0: HR=1.54 (0.92-2.57) p(MCS)=0.0995 1: HR=1.34 (0.79-2.27) p(MCS)=0.2729 p(PA0)=0.0130 p(PA1)=0.9068	0: 8.45% **1: 10.74%**
Crude	MCS (restricted to those with BMI)		0: 110 1: 108 2: 106	n=324 d=85		0: HR=1.42 (0.83-2.43) 1: HR=1.27 (0.74-2.18)	p=0.4304	0: HR=1.42 (0.83-2.43) p(MCS)=0.1963 1: HR=1.27 (0.74-2.18) p(MCS)=0.3968	--
21	Body Mass Index (BMI)	0: <25 (REF) 1: 25-29 2: ≥30	0: 161 1: 99 2: 64	n=324 d=85	27	0: HR=1.00 1: HR=0.91 (0.54-1.52) 2: HR=1.52 (0.89-2.59)	**p=0.1846**	0: HR=1.42 (0.83-2.42) p(MCS)=0.2046 1: HR=1.35 (0.78-2.33) p(MCS)=0.2913 p(BMI1)=0.7102 p(BMI2)=0.1235	0: 0.00% 1: 6.30%
Crude	MCS (restricted to those tumor subtype)		0: 99 1: 99 2: 102	n=300 d=87		0: HR=1.16 (0.69-1.94) 1: HR=1.06 (0.63-1.78)	p=0.8474	0: HR=1.16 (0.69-1.94) p(MCS)=0.5696 1: HR=1.06 (0.63-1.78) p(MCS)=0.8290	--

Model	Variable(s) in model	Categories	Total in categories (n)	Total in model (n); dead (d)	Missing	Univariate-Cox HR (95% CI)	p-values*	MCS HR (95% CI) and p-values	% change from crude model
22	Tumor Subtype	0: ER+ (REF) 1: ER-	0: 251 1: 49	n=300 d=87	51	0: HR=1.00 1: HR=1.17 (0.68-2.02)	p=0.5712	0: HR=1.16 (0.69-1.94) p(MCS)=0.5832 1: HR=1.05 (0.62-1.76) p(MCS)=0.8604 p(Subtype)=0.5712	0: 0.00% 1: 0.94%

*Bolded p-values are <0.25.

Appendix F. Percent Change from Crude Model and Model 1 with Each Potential Confounder (MCS & All-Cause Mortality) (*N* = 351)

Model	Variable(s) in model	Mental Component Summary Score (MCS) (95% CI)	Difference in 'N'	Total in model (n) and total dead (d)	% change from Crude	% change from model 1
Dataset restricted to those with full HRQOL data and baseline covariates						
Crude	Mental Component Summary Score (MCS)	0: HR=1.36 (0.83-2.23) 1: HR=1.25 (0.76-2.06) 2: HR=1.00 (REF) p=0.4590	0	n=351 d=99	--	--
1	Age, Marital Status, & Tumor Stage	0: HR=1.67 (1.01-2.75) 1: HR=1.32 (0.80-2.18) 2: HR=1.00 (REF) p=0.1319	0	n=351 d=99	**0: 22.79%** 1: 5.60%	--
2	Model 1 + Race/Ethnicity	0: HR=1.69 (1.03-2.79) 1: HR=1.33 (0.81-2.19) 2: HR=1.00 (REF) p=0.1208	0	n=351 d=99	**0: 24.26%** 1: 6.40%	0: 1.20% 1: 0.76%
3	Model 1 + Treatment Type	0: HR=1.63 (0.99-2.68) 1: HR=1.27 (0.77-2.09) 2: HR=1.00 (REF) p=0.1560	0	n=351 d=99	**0: 19.85%** 1: 1.60%	0: 2.40% 1: 3.79%

Model	Variable(s) in model	Mental Component Summary Score (MCS) (95% CI)	Difference in 'N'	Total in model (n) and total dead (d)	% change from Crude	% change from model 1
4	Model 1 + Comorbidities	0: HR=1.56 (0.93-2.59) 1: HR=1.33 (0.81-2.19) 2: HR=1.00 (REF) p=0.2308	0	n=351 d=99	**0: 14.71%** 1: 2.21%	0: 6.59% 1: 0.76%
5	Model 1 + Current Lymphedema	0: HR=1.71 (1.03-2.82) 1: HR=1.33 (0.81-2.19) 2: HR=1.00 (REF) p=0.1137	0	n=351 d=99	**0: 25.74%** 1: 6.40%	0: 2.40% 1: 0.76%
6	Model 1 + Optimism	0: HR=1.57 (0.94-2.62) 1: HR=1.26 (0.76-2.09) 2: HR=1.00 (REF) p=0.2271	0	n=351 d=99	**0: 15.44%** 1: 0.80%	0: 5.99% 1: 4.55%
7	Model 1 + Pessimism	0: HR=1.47 (0.88-2.45) 1: HR=1.25 (0.75-2.06) 2: HR=1.00 (REF) p=0.3316	0	n=351 d=99	0: 8.09% 1: 0.00%	**0: 11.98%** 1: 5.30%
8	Model 1 + Current Fatigue	0: HR=1.78 (1.01-3.14) 1: HR=1.35 (0.81-2.25) 2: HR=1.00 (REF) p=0.1358	0	n=351 d=99	**0: 30.88%** 1: 8.00%	0: 6.59% 1: 2.27%

Model	Variable(s) in model	Mental Component Summary Score (MCS) (95% CI)	Difference in 'N'	Total in model (n) and total dead (d)	% change from Crude	% change from model 1
9	Model 1 + Fear of Recurrence	0: HR=1.71 (1.04-2.83) 1: HR=1.35 (0.82-2.22) 2: HR=1.00 (REF) p=0.1111	0	n=351 d=99	**0: 25.74%** 1: 8.00%	0: 2.40% 1: 2.27%
10	Model 1 + Number of Types of Confidants	0: HR=1.67 (1.02-2.76) 1: HR=1.34 (0.81-2.21) 2: HR=1.00 (REF) p=0.1295	0	n=351 d=99	**0: 22.79%** 1: 7.20%	0: 0.00% 1: 1.52%
11	Model 1 + Bodily Pain	0: HR=1.58 (0.96-2.62) 1: HR=1.28 (0.78-2.11) 2: HR=1.00 (REF) p=0.2053	0	n=351 d=99	**0: 16.18%** 1: 2.40%	0: 5.39% 1: 3.03%
12	Model 1 + Perceived General Health	0: HR=1.41 (0.83-2.37) 1: HR=1.31 (0.80-2.16) 2: HR=1.00 (REF) p=0.5532	0	n=351 d=99	0: 3.68% 1: 4.80%	**0: 15.57%** 1: 0.76%
Subset--Restricted to participants with Education variable						

Model	Variable(s) in model	Mental Component Summary Score (MCS) (95% CI)	Difference in 'N'	Total in model (n) and total dead (d)	% change from Crude	% change from model 1
Crude	Mental Component Summary Score (MCS)	0: HR=1.36 (0.83-2.23) 1: HR=1.22 (0.74-2.01) 2: HR=1.00 (REF) p=0.4628	1	n=350 d=98	--	--
1	Age, Marital Status, & Tumor Stage	0: HR=1.62 (0.99-2.65) 1: HR=1.31 (0.80-2.16) 2: HR=1.00 (REF) p=0.1645	1	n=350 d=98	**0: 19.12%** 1: 7.38%	--
13	Model 1 + Education	0: HR=1.64 (0.99-2.70) 1: HR=1.37 (0.83-2.28) 2: HR=1.00 (REF) p=0.1498	1	n=350 d=98	**0: 20.59%** **1: 12.30%**	0: 1.23% 1: 4.58%
Subset--Restricted to participants with the Tumor Size variable						
Crude	Mental Component Summary Score (MCS)	0: HR=1.38 (0.84-2.27) 1: HR=1.26 (0.77-2.07) 2: HR=1.00 (REF) p=0.4244	10	n=341 d=99	--	--

Model	Variable(s) in model	Mental Component Summary Score (MCS) (95% CI)	Difference in 'N'	Total in model (n) and total dead (d)	% change from Crude	% change from model 1
1	Age, Marital Status, & Tumor Stage	0: HR=1.66 (1.01-2.73) 1: HR=1.32 (0.80-2.17) 2: HR=1.00 (REF) p=0.1392	10	n=341 d=99	**0: 20.29%** 1: 4.76%	--
14	Model 1 + Tumor Size	0: HR=1.64 (1.00-2.70) 1: HR=1.36 (0.82-2.24) 2: HR=1.00 (REF) p=0.1496	10	n=341 d=99	**0: 18.84%** 1: 7.94%	0: 1.20% 1: 3.03%
Subset--Restricted to participants with Lymph Node Involvement variable						
Crude	Mental Component Summary Score (MCS)	0: HR=1.18 (0.71-1.96) 1: HR=1.19 (0.72-1.97) 2: HR=1.00 (REF) p=0.7579	10	n=341 d=92	--	--
1	Age, Marital Status, & Tumor Stage	0: HR=1.49 (0.89-2.49) 1: HR=1.33 (0.80-2.21) 2: HR=1.00 (REF) p=0.2946	10	n=341 d=92	**0: 26.27%** **1: 11.76%**	--

Model	Variable(s) in model	Mental Component Summary Score (MCS) (95% CI)	Difference in 'N'	Total in model (n) and total dead (d)	% change from Crude	% change from model 1
15	Model 1 + Lymph Node Involvement	0: HR=1.48 (0.88-2.48) 1: HR=1.32 (0.80-2.20) 2: HR=1.00 (REF) p=0.3132	10	n=341 d=92	**0: 25.42%** **1: 10.92%**	0: 0.67% 1: 0.75%
Subset--Restricted to participants with Tamoxifen Use, Smoking Status, & Physical Activity variables (24-month follow-up)						
Crude	Mental Component Summary Score (MCS)	0: HR=1.42 (0.85-2.36) 1: HR=1.21 (0.72-2.03) 2: HR=1.00 (REF) p=0.4071	21	n=330 d=91	--	--
1	Age, Marital Status, & Tumor Stage	0: HR=1.69 (1.01-2.83) 1: HR=1.32 (0.78-2.23) 2: HR=1.00 (REF) p=0.1360	21	n=330 d=91	**0: 19.01%** 1: 9.09%	--
16	Model 1 + Tamoxifen Use	0: HR=1.74 (1.04-2.92) 1: HR=1.28 (0.76-2.17) 2: HR=1.00 (REF) p=0.1046	21	n=330 d=91	**0: 22.54%** 1: 5.79%	0: 2.96% 1: 3.03%

Model	Variable(s) in model	Mental Component Summary Score (MCS) (95% CI)	Difference in 'N'	Total in model (n) and total dead (d)	% change from Crude	% change from model 1
17	Model 1 + Smoking Status	0: HR=1.64 (0.98-2.75) 1: HR=1.32 (0.78-2.22) 2: HR=1.00 (REF) p=0.1753	21	n=330 d=91	**0: 15.49%** 1: 9.09%	0: 2.96% 1: 0.00%
18	Model 1 + Physical Activity	0: HR=1.71 (1.02-2.87) 1: HR=1.41 (0.83-2.39) 2: HR=1.00 (REF) p=0.1230	21	n=330 d=91	**0: 20.42%** **1: 16.53%**	0: 1.18% 1: 6.82%
Subset--Restricted to participants with BMI variable						
Crude	Mental Component Summary Score (MCS)	0: HR=1.42 (0.83-2.43) 1: HR=1.27 (0.74-2.18) 2: HR=1.00 (REF) p=0.4304	27	n=324 d=85	--	--
1	Age, Marital Status, & Tumor Stage	0: HR=1.73 (1.01-2.97) 1: HR=1.27 (0.74-2.20) 2: HR=1.00 (REF) p=0.1335	27	n=324 d=85	**0: 21.83%** 1: 0.00%	--

Model	Variable(s) in model	Mental Component Summary Score (MCS) (95% CI)	Difference in 'N'	Total in model (n) and total dead (d)	% change from Crude	% change from model 1
19	Model 1 + BMI	0: HR=1.72 (1.00-2.96) 1: HR=1.32 (0.76-2.28) 2: HR=1.00 (REF) p=0.1492	27	n=324 d=85	**0: 21.13%** 1: 3.94%	0: 0.58% 1: 3.94%
Subset--Restricted to participants with Tumor Subtype variable						
Crude	Mental Component Summary Score (MCS)	0: HR=1.16 (0.69-1.94) 1: HR=1.06 (0.63-1.78) 2: HR=1.00 (REF) p=0.8481	51	n=300 d=87	--	--
1	Age, Marital Status, & Tumor Stage	0: HR=1.39 (0.83-2.34) 1: HR=1.12 (0.67-1.89) 2: HR=1.00 (REF) p=0.4426	51	n=300 d=87	**0: 19.83%** 1: 5.66%	--
20	Model 1 + Tumor Subtype	0: HR=1.42 (0.85-2.39) 1: HR=1.12 (0.66-1.88) 2: HR=1.00 (REF) p=0.3926	51	n=300 d=87	**0: 22.41%** 1: 5.66%	0: 2.16% 1: 0.00%

*Model 1 is considered the 'base' for adjustment when PCS is the predictor.

Appendix G. Multivariable Modeling with Mental Component Summary Score as the Predictor and All-Cause Mortality as the Outcome (*N* = 351)

Model	Variable(s) in model	Mental Component Summary Score (MCS) HR (95% CI)	Difference in 'N'	Total in model (n) and total dead (d)	% change from Crude	% change from model 1	% change from previous model
Crude	Mental Component Summary Score (MCS)	0: HR=1.36 (0.83-2.23) 1: HR=1.25 (0.76-2.06) 2: HR=1.00 (REF) p=0.4590	0	n=351 d=99	--	--	--
1	Age, Marital Status, & Tumor Stage	0: HR=1.67 (1.01-2.75) 1: HR=1.32 (0.80-2.18) 2: HR=1.00 (REF) p=0.1319	0	n=351 d=99	**0: 22.79%** 1: 5.60%	--	--
2	Model 1 + Race/Ethnicity	0: HR=1.69 (1.03-2.79) 1: HR=1.33 (0.81-2.19) 2: HR=1.00 (REF) p=0.1208	0	n=351 d=99	**0: 24.26%** 1: 6.40%	0: 1.20% 1: 0.76%	--
3	Model 1 + Race/Ethnicity + Treatment Type	0: HR=1.64 (1.00-2.71) 1: HR=1.27 (0.77-2.10) 2: HR=1.00 (REF) p=0.1468	0	n=351 d=99	**0: 20.59%** 1: 1.60%	0: 1.80% 1: 3.79%	0: 2.96% 1: 4.51%
4	Model 1 + Race/Ethnicity + Treatment Type + Comorbidities	0: HR=1.51 (0.90-2.53) 1: HR=1.27 (0.77-2.10) 2: HR=1.00 (REF) p=0.2871	0	n=351 d=99	**0: 11.03%** 1: 1.60%	0: 9.58% 1: 3.79%	0: 7.93% 1: 0.00%

Model	Variable(s) in model	Mental Component Summary Score (MCS) HR (95% CI)	Difference in 'N'	Total in model (n) and total dead (d)	% change from Crude	% change from model 1	% change from previous model
5	Model 1 + Race/Ethnicity + Treatment Type + Comorbidities + Current Lymphedema	0: HR=1.56 (0.93-2.61) 1: HR=1.30 (0.79-2.14) 2: HR=1.00 (REF) p=0.2397	0	n=351 d=99	**0: 14.71%** 1: 4.00%	0: 6.59% 1: 1.52%	0: 3.31% 1: 2.36%
6	Model 1 + Race/Ethnicity + Treatment Type + Comorbidities + Current Lymphedema + Pessimism	0: HR=1.41 (0.83-2.37) 1: HR=1.24 (0.75-2.06) 2: HR=1.00 (REF) p=0.4326	0	n=351 d=99	0: 3.68% 1: 0.80%	**0: 15.57%** 1: 6.06%	0: 9.62% 1: 4.62%
7	Model 1 + Race/Ethnicity + Treatment Type + Comorbidities + Current Lymphedema + Pessimism + Fear of Recurrence	0: HR=1.44 (0.85-2.42) 1: HR=1.27 (0.76-2.11) 2: HR=1.00 (REF) p=0.3898	0	n=351 d=99	**0: 5.88%** **1: 1.60%**	**0: 13.77%** 1: 3.79%	0: 2.13% 1: 2.42%
8	Model 1 + Race/Ethnicity + Treatment Type + Comorbidities + Current Lymphedema + Pessimism + Fear of Recurrence + Number of Types of Confidants (Confide)	0: HR=1.45 (0.86-2.46) 1: HR=1.29 (0.78-2.15) 2: HR=1.00 (REF) p=0.3664	0	n=351 d=99	0: 6.62% 1: 3.20%	**0: 13.17%** 1: 2.27%	0: 0.69% 1: 1.57%
9	Model 1 + Race/Ethnicity + Treatment Type + Comorbidities + Current Lymphedema + Pessimism + Fear of Recurrence + Confide + Bodily Pain	0: HR=1.40 (0.82-2.38) 1: HR=1.26 (0.76-2.11) 2: HR=1.00 (REF) p=0.4499	0	n=351 d=99	0: 2.94% 1: 0.80%	**0: 16.17%** 1: 4.55%	0: 3.45% 1: 2.33%

Model	Variable(s) in model	Mental Component Summary Score (MCS) HR (95% CI)	Difference in 'N'	Total in model (n) and total dead (d)	% change from Crude	% change from model 1	% change from previous model
10	Model 1 + Race/Ethnicity + Treatment Type + Comorbidities + Current Lymphedema + Pessimism + Fear of Recurrence + Confide + Bodily Pain + Perceived General Health	0: HR=1.24 (0.72-2.15) 1: HR=1.26 (0.76-2.10) 2: HR=1.00 (REF) p=0.6340	0	n=351 d=99	0: 8.82% 1: 0.80%	**0: 25.75%** 1: 4.55%	**0: 11.43%** 1: 0.00%
Subset--Restricted to participants with Education variable							
Crude	Mental Component Summary Score (MCS)	0: HR=1.36 (0.83-2.23) 1: HR=1.22 (0.74-2.01) 2: HR=1.00 (REF) p=0.4628	1	n=350 d=98	--	--	--
1	Age, Marital Status, & Tumor Stage	0: HR=1.66 (1.01-2.74) 1: HR=1.30 (0.79-2.14) 2: HR=1.00 (REF) p=0.1352	1	n=350 d=98	**0: 22.06%** 1: 6.56%	--	--
11	Model 1 + Education	0: HR=1.64 (1.00-2.70) 1: HR=1.37 (0.83-2.28) 2: HR=1.00 (REF) p=0.1498	1	n=350 d=98	**0: 20.59%** **1: 12.30%**	0: 1.20% 1: 5.38%	--

Model	Variable(s) in model	Mental Component Summary Score (MCS) HR (95% CI)	Difference in 'N'	Total in model (n) and total dead (d)	% change from Crude	% change from model 1	% change from previous model
12	Model 1 + Education + Race/Ethnicity	0: HR=1.66 (1.01-4.04) 1: HR=1.40 (0.84-2.34) 2: HR=1.00 (REF) p=0.1333	1	n=350 d=98	**0: 22.06%** **1: 14.75%**	0: 0.00% 1: 7.69%	0: 1.22% 1: 2.19%
13	Model 1 + Education + Race/Ethnicity + Treatment Type	0: HR=1.61 (0.98-2.65) 1: HR=1.35 (0.81-2.25) 2: HR=1.00 (REF) p=0.1714	1	n=350 d=98	**0: 18.38%** **1: 10.66%**	0: 3.01% 1: 3.85%	0: 3.01% 1: 3.57%
14	Model 1 + Education + Race/Ethnicity + Treatment Type + Comorbidities	0: HR=1.50 (0.90-2.51) 1: HR=1.33 (0.80-2.22) 2: HR=1.00 (REF) p=0.2847	1	n=350 d=98	**0: 10.29%** 1: 9.02%	0: 9.64% 1: 2.31%	0: 6.83% 1: 1.48%
15	Model 1 + Education + Race/Ethnicity + Treatment Type + Comorbidities + Current Lymphedema	0: HR=1.54 (0.92-2.58) 1: HR=1.34 (0.81-2.24) 2: HR=1.00 (REF) p=0.2447	1	n=350 d=98	**0: 13.24%** **1: 9.84%**	**0: 18.46%** 1: 3.08%	0: 2.67% 1: 0.75%
16	Model 1 + Education + Race/Ethnicity + Treatment Type + Comorbidities + Current Lymphedema + Pessimism	0: HR=1.39 (0.83-2.35) 1: HR=1.28 (0.76-2.13) 2: HR=1.00 (REF) p=0.4368	1	n=350 d=98	0: 2.21% 1: 4.92%	**0: 16.27%** 1: 1.54%	0: 9.74% 1: 4.48%

Model	Variable(s) in model	Mental Component Summary Score (MCS) HR (95% CI)	Difference in 'N'	Total in model (n) and total dead (d)	% change from Crude	% change from model 1	% change from previous model
17	Model 1 + Education + Race/Ethnicity + Treatment Type + Comorbidities + Current Lymphedema + Pessimism + Fear of Recurrence	0: HR=1.43 (0.85-2.41) 1: HR=1.31 (0.78-2.20) 2: HR=1.00 (REF) p=0.3834	1	n=350 d=98	0: 5.15% 1: 7.38%	**0: 13.86%** 1: 0.77%	0: 2.88% 1: 2.34%
18	Model 1 + Education + Race/Ethnicity + Treatment Type + Comorbidities + Current Lymphedema + Pessimism + Fear of Recurrence + Confide	0: HR=1.44 (0.85-2.44) 1: HR=1.33 (0.79-2.24) 2: HR=1.00 (REF) p=0.3641	1	n=350 d=98	0: 5.88% 1: 9.02%	**0: 13.25%** 1: 2.31%	0: 0.70% 1: 1.53%
19	Model 1 + Education + Race/Ethnicity + Treatment Type + Comorbidities + Current Lymphedema + Pessimism + Fear of Recurrence + Confide + Bodily Pain	0: HR=1.39 (0.82-2.36) 1: HR=1.31 (0.78-2.21) 2: HR=1.00 (REF) p=0.4419	1	n=350 d=98	0: 2.21% 1: 7.38%	**0: 16.27%** 1: 0.77%	0: 3.47% 1: 1.50%
20	Model 1 + Education + Race/Ethnicity + Treatment Type + Comorbidities + Current Lymphedema + Pessimism + Fear of Recurrence + Confide+ Bodily Pain + Perceived General Health	0: HR=1.25 (0.72-2.15) 1: HR=1.30 (0.77-2.19) 2: HR=1.00 (REF) p=0.5877	1	n=350 d=98	0: 8.09% 1: 6.56%	**0: 24.70%** 1: 0.00%	**0: 10.07%** 1: 0.76%
Subset--Restricted to participants with Physical Activity variable (24-month follow-up)							

Model	Variable(s) in model	Mental Component Summary Score (MCS) HR (95% CI)	Difference in 'N'	Total in model (n) and total dead (d)	% change from Crude	% change from model 1	% change from previous model
Crude	Mental Component Summary Score (MCS)	0: HR=1.42 (0.85-2.36) 1: HR=1.21 (0.72-2.03) 2: HR=1.00 (REF) p=0.4106	21	n=330 d=91	--	--	--
1	Age, Marital Status, & Tumor Stage	0: HR=1.69 (1.01-2.83) 1: HR=1.32 (0.78-2.23) 2: HR=1.00 (REF) p=0.1360	21	n=330 d=91	**0: 19.01%** 1: 9.09%	--	--
21	Model 1 + Physical Activity	0: HR=1.71 (1.02-2.87) 1: HR=1.41 (0.83-2.39) 2: HR=1.00 (REF) p=0.1230	21	n=330 d=91	**0: 20.42%** **1: 16.53%**	0: 1.18% 1: 6.82%	--
22	Model 1 + Physical Activity + Race/Ethnicity	0: HR=1.74 (1.04-2.93) 1: HR=1.41 (0.83-2.40) 2: HR=1.00 (REF) p=0.1084	21	n=330 d=91	**0: 22.54%** **1: 16.53%**	0: 2.96% 1: 6.82%	0: 1.75% 1: 0.00%
23	Model 1 + Physical Activity + Race/Ethnicity + Treatment Type	0: HR=1.72 (1.03-2.88) 1: HR=1.37 (0.80-2.33) 2: HR=1.00 (REF) p=0.1216	21	n=330 d=91	**0: 21.13%** **1: 13.22%**	0: 1.78% 1: 3.79%	0: 1.15% 1: 2.84%

Model	Variable(s) in model	Mental Component Summary Score (MCS) HR (95% CI)	Difference in 'N'	Total in model (n) and total dead (d)	% change from Crude	% change from model 1	% change from previous model
24	Model 1 + Physical Activity + Race/Ethnicity + Treatment Type + Comorbidities	0: HR=1.59 (0.94-2.70) 1: HR=1.37 (0.80-2.34) 2: HR=1.00 (REF) p=0.2217	21	n=330 d=91	**0: 46.48%** **1: 25.00%**	**0: 12.84%** 1: 5.65%	0: 6.40% 1: 1.68%
25	Model 1 + Physical Activity + Race/Ethnicity + Treatment Type + Comorbidities + Current Lymphedema	0: HR=1.60 (0.94-2.73) 1: HR=1.40 (0.82-2.39) 2: HR=1.00 (REF) p=0.2048	21	n=330 d=91	**0: 12.68%** **1: 15.70%**	0: 5.33% 1: 6.06%	0: 0.63% 1: 2.19%
26	Model 1 + Physical Activity + Race/Ethnicity + Treatment Type + Comorbidities + Current Lymphedema + Pessimism	0: HR=1.50 (0.88-2.57) 1: HR=1.38 (0.81-2.37) 2: HR=1.00 (REF) p=0.3011	21	n=330 d=91	0: 5.63% **1: 14.05%**	**0: 11.24%** 1: 4.55%	0: 6.25% 1: 1.43%
27	Model 1 + Physical Activity + Race/Ethnicity + Treatment Type + Comorbidities + Current Lymphedema + Pessimism + Fear of Recurrence	0: HR=1.51 (0.88-2.59) 1: HR=1.39 (0.81-2.38) 2: HR=1.00 (REF) p=0.2958	21	n=330 d=91	0: 6.34% **1: 14.88%**	**0: 10.65%** 1: 5.30%	0: 0.67% 1: 0.72%
28	Model 1 + Physical Activity + Race/Ethnicity + Treatment Type + Comorbidities + Current Lymphedema + Pessimism + Fear of Recurrence + Confide	0: HR=1.55 (0.89-2.68) 1: HR=1.41 (0.82-2.42) 2: HR=1.00 (REF) p=0.2686	21	n=330 d=91	0: 9.15% **1: 16.53%**	0: 8.28% 1: 6.82%	0: 2.65% 1: 1.44%

Model	Variable(s) in model	Mental Component Summary Score (MCS) HR (95% CI)	Difference in 'N'	Total in model (n) and total dead (d)	% change from Crude	% change from model 1	% change from previous model
29	Model 1 + Physical Activity + Race/Ethnicity + Treatment Type + Comorbidities + Current Lymphedema + Pessimism + Fear of Recurrence + Confide + Bodily Pain	0: HR=1.48 (0.85-2.59) 1: HR=1.38 (0.80-2.38) 2: HR=1.00 (REF) p=0.3478	21	n=330 d=91	0: 4.23% **1: 14.05%**	**0: 12.43%** 1: 4.55%	0: 4.52% 1: 2.13%
30	Model 1 + Physical Activity + Race/Ethnicity + Treatment Type + Comorbidities + Current Lymphedema + Pessimism + Fear of Recurrence + Confide + Bodily Pain + Perceived General Health	0: HR=1.31 (0.73-2.33) 1: HR=1.34 (0.78-2.31) 2: HR=1.00 (REF) p=0.5299	21	n=330 d=91	0: 7.75% **1: 10.74%**	**0: 22.49%** 1: 1.52%	**0: 11.49%** 1: 2.90%
Subset--Restricted to participants with Education and Physical Activity variables							
Crude	Mental Component Summary Score (MCS)	0: HR=1.42 (0.85-2.36) 1: HR=1.17 (0.69-1.98) 2: HR=1.00 (REF) p=0.4045	22	n=329 d=90	--	--	--
1	Age, Marital Status, & Tumor Stage	0: HR=1.68 (1.01-2.82) 1: HR=1.29 (0.76-2.18) 2: HR=1.00 (REF) p=0.1388	22	n=329 d=90	**0: 18.31%** **1: 10.26%**	--	--

Model	Variable(s) in model	Mental Component Summary Score (MCS) HR (95% CI)	Difference in 'N'	Total in model (n) and total dead (d)	% change from Crude	% change from model 1	% change from previous model
31	Model 1 + Education + Physical Activity	0: HR=1.66 (0.99-2.78) 1: HR=1.40 (0.82-2.39) 2: HR=1.00 (REF) p=0.1535	22	n=329 d=90	**0: 16.90%** **1: 19.66%**	0: 1.19% 1: 8.53%	--
32	Model 1 + Education + Physical Activity + Race/Ethnicity	0: HR=1.69 (1.01-2.83) 1: HR=1.42 (0.83-2.43) 2: HR=1.00 (REF) p=0.1362	22	n=329 d=90	**0: 19.01%** **1: 21.37%**	0: 0.60% **1: 10.08%**	0: 1.81% 1: 1.43%
33	Model 1 + Education + Physical Activity + Race/Ethnicity + Treatment Type	0: HR=1.66 (0.99-2.78) 1: HR=1.38 (0.80-2.38) 2: HR=1.00 (REF) p=0.1584	22	n=329 d=90	**0: 16.90%** **1: 17.95%**	0: 1.19% 1: 6.98%	0: 1.78% 1: 2.82%
34	Model 1 + Education + Physical Activity + Race/Ethnicity + Treatment Type + Comorbidities	0: HR=1.54 (0.91-2.62) 1: HR=1.37 (0.80-2.36) 2: HR=1.00 (REF) p=0.2578	22	n=329 d=90	0: 8.45% **1: 17.09%**	0: 8.33% 1: 6.20%	0: 7.23% 1: 0.72%
35	Model 1 + Education + Physical Activity + Race/Ethnicity + Treatment Type + Comorbidities + Current Lymphedema	0: HR=1.56 (0.92-2.65) 1: HR=1.39 (0.81-2.39) 2: HR=1.00 (REF) p=0.2404	22	n=329 d=90	0: 9.86% **1: 18.80%**	0: 7.14% 1: 7.75%	0: 1.30% 1: 1.46%

Model	Variable(s) in model	Mental Component Summary Score (MCS) HR (95% CI)	Difference in 'N'	Total in model (n) and total dead (d)	% change from Crude	% change from model 1	% change from previous model
36	Model 1 + Education + Physical Activity + Race/Ethnicity + Treatment Type + Comorbidities + Current Lymphedema + Pessimism	0: HR=1.46 (0.85-2.50) 1: HR=1.37 (0.79-2.36) 2: HR=1.00 (REF) p=0.3446	22	n=329 d=90	0: 2.82% **1: 17.09%**	**0: 13.1%** 1: 6.20%	0: 6.41% 1: 1.44%
37	Model 1 + Education + Physical Activity + Race/Ethnicity + Treatment Type + Comorbidities + Current Lymphedema + Pessimism + Fear of Recurrence	0: HR=1.47 (0.86-2.52) 1: HR=1.37 (0.80-2.37) 2: HR=1.00 (REF) p=0.3356	22	n=329 d=90	0: 3.52% **1: 17.09%**	**0: 12.50%** 1: 6.20%	0: 0.68% 1: 0.00%
38	Model 1 + Education + Physical Activity + Race/Ethnicity + Treatment Type + Comorbidities + Current Lymphedema + Pessimism + Fear of Recurrence + Confide	0: HR=1.50 (0.86-2.59) 1: HR=1.39 (0.80-2.40) 2: HR=1.00 (REF) p=0.3178	22	n=329 d=90	0: 5.63% **1: 18.80%**	**0: 10.71%** 1: 7.75%	0: 2.04% 1: 1.46%
39	Model 1 + Education + Physical Activity + Race/Ethnicity + Treatment Type + Comorbidities + Current Lymphedema + Pessimism + Fear of Recurrence + Confide + Bodily Pain	0: HR=1.43 (0.82-2.51) 1: HR=1.37 (0.79-2.37) 2: HR=1.00 (REF) p=0.3985	22	n=329 d=90	0: 0.70% **1: 17.09%**	**0: 14.88%** 1: 6.20%	0: 4.67% 1: 1.44%
40	Model 1 + Education + Physical Activity + Race/Ethnicity + Treatment Type + Comorbidities + Current Lymphedema + Pessimism + Fear of Recurrence + Confide + Bodily Pain + Perceived General Health	0: HR=1.28 (0.72-2.29) 1: HR=1.33 (0.76-2.31) 2: HR=1.00 (REF) p=0.5655	22	n=329 d=90	0: 9.86% **1: 13.68%**	**0: 23.81%** 1: 3.10%	**0: 10.49%** 1: 2.92%

Model	Variable(s) in model	Mental Component Summary Score (MCS) HR (95% CI)	Difference in 'N'	Total in model (n) and total dead (d)	% change from Crude	% change from model 1	% change from previous model
Subset--Restricted to participants with BMI variable							
Crude	Mental Component Summary Score (MCS)	0: HR=1.42 (0.83-2.43) 1: HR=1.27 (0.74-2.18) 2: HR=1.00 (REF) p=0.4304	27	n=324 d=85	--	--	--
1	Age, Marital Status, & Tumor Stage	0: HR=1.73 (1.01-2.97) 1: HR=1.27 (0.74-2.20) 2: HR=1.00 (REF) p=0.1335	27	n=324 d=85	**0: 21.83%** 1: 0.00%	--	--
41	Model 1 + Education + BMI	0: HR=1.72 (1.00-2.96) 1: HR=1.32 (0.76-2.28) 2: HR=1.00 (REF) p=0.1492	27	n=324 d=85	**0: 21.13%** 1: 3.94%	0: 0.58% 1: 3.94%	--
42	Model 1 + Education + BMI + Race/Ethnicity	0: HR=1.75 (1.01-3.02) 1: HR=1.33 (0.77-2.32) 2: HR=1.00 (REF) p=0.1360	27	n=324 d=85	**0: 23.24%** 1: 4.72%	0: 1.16% 1: 4.72%	0: 1.74% 1: 0.76%
43	Model 1 + Education + BMI + Race/Ethnicity + Treatment Type	0: HR=1.67 (0.97-2.89) 1: HR=1.23 (0.70-2.15) 2: HR=1.00 (REF) p=0.1739	27	n=324 d=85	**0: 17.61%** 1: 3.15%	**0: 31.50%** 1: 3.15%	0: 4.57% 1: 7.52%

Model	Variable(s) in model	Mental Component Summary Score (MCS) HR (95% CI)	Difference in 'N'	Total in model (n) and total dead (d)	% change from Crude	% change from model 1	% change from previous model
44	Model 1 + Education + BMI + Race/Ethnicity + Treatment Type + Comorbidities	0: HR=1.61 (0.92-2.82) 1: HR=1.22 (0.70-2.14) 2: HR=1.00 (REF) p=0.2370	27	n=324 d=85	**0: 13.38%** 1: 3.94%	0: 6.94% 1: 3.94%	0: 3.59% 1: 0.81%
45	Model 1 + Education + BMI + Race/Ethnicity + Treatment Type + Comorbidities + Current Lymphedema	0: HR=1.69 (0.96-2.95) 1: HR=1.25 (0.71-2.20) 2: HR=1.00 (REF) p=0.1838	27	n=324 d=85	**0: 19.01%** 1: 1.57%	0: 2.31% 1: 1.57%	0: 4.97% 1: 2.46%
46	Model 1 + Education + BMI + Race/Ethnicity + Treatment Type + Comorbidities + Current Lymphedema + Pessimism	0: HR=1.52 (0.86-2.67) 1: HR=1.19 (0.68-2.08) 2: HR=1.00 (REF) p=0.3423	27	n=324 d=85	0: 7.04% 1: 6.30%	**0: 12.14%** 1: 6.30%	**0: 10.06%** 1: 4.80%
47	Model 1 + Education + BMI + Race/Ethnicity + Treatment Type + Comorbidities + Current Lymphedema + Pessimism + Fear of Recurrence	0: HR=1.54 (0.88-2.71) 1: HR=1.21 (0.69-2.14) 2: HR=1.00 (REF) p=0.3206	27	n=324 d=85	0: 8.45% 1: 4.72%	**0: 10.98%** 1: 4.72%	0: 1.32% 1: 1.68%
48	Model 1 + Education + BMI + Race/Ethnicity + Treatment Type + Comorbidities + Current Lymphedema + Pessimism + Fear of Recurrence + Confide	0: HR=1.56 (0.88-2.74) 1: HR=1.22 (0.69-2.14) 2: HR=1.00 (REF) p=0.3061	27	n=324 d=85	0: 9.86% 1: 3.94%	0: 9.83% 1: 3.94%	0: 1.30% 1: 0.83%

Model	Variable(s) in model	Mental Component Summary Score (MCS) HR (95% CI)	Difference in 'N'	Total in model (n) and total dead (d)	% change from Crude	% change from model 1	% change from previous model
49	Model 1 + Education + BMI + Race/Ethnicity + Treatment Type + Comorbidities + Current Lymphedema + Pessimism + Fear of Recurrence + Confide + Bodily Pain	0: HR=1.54 (0.87-2.71) 1: HR=1.20 (0.68-2.12) 2: HR=1.00 (REF) p=0.3289	27	n=324 d=85	0: 8.45% 1: 5.51%	**0: 10.98%** 1: 5.51%	0: 1.28% 1: 1.64%
50	Model 1 + Education + BMI + Race/Ethnicity + Treatment Type + Comorbidities + Current Lymphedema + Pessimism + Fear of Recurrence + Confide + Bodily Pain + Perceived General Health	0: HR=1.37 (0.76-2.46) 1: HR=1.18 (0.67-2.08) 2: HR=1.00 (REF) p=0.5805	27	n=324 d=85	0: 3.52% 1: 7.09%	**0: 20.81%** 1: 7.09%	**0: 11.04%** 1: 1.67%
Subset--Restricted to participants with Education, Physical Activity, and BMI variables							
Crude	Mental Component Summary Score (MCS)	0: HR=1.51 (0.87-2.64) 1: HR=1.21 (0.68-2.15) 2: HR=1.00 (REF) p=0.3415	46	n=305 d=77	--	--	--
1	Age, Marital Status, & Tumor Stage	0: HR=1.84 (1.05-3.22) 1: HR=1.31 (0.74-2.33) 2: HR=1.00 (REF) p=0.1006	46	n=305 d=77	**0: 21.85%** 1: 8.26%	--	--

Model	Variable(s) in model	Mental Component Summary Score (MCS) HR (95% CI)	Difference in 'N'	Total in model (n) and total dead (d)	% change from Crude	% change from model 1	% change from previous model
51	Model 1 + Education + Physical Activity + BMI	0: HR=1.78 (1.01-3.14) 1: HR=1.46 (0.81-2.64) 2: HR=1.00 (REF) p=0.1317	46	n=305 d=77	**0: 17.88%** **1: 20.66%**	0: 3.26% **1: 11.45%**	--
52	Model 1 + Education + Physical Activity + BMI + Race/Ethnicity	0: HR=1.84 (1.04-3.26) 1: HR=1.51 (0.83-2.73) 2: HR=1.00 (REF) p=0.1064	46	n=305 d=77	**0: 21.85%** **1: 24.79%**	0: 0.00% **1: 15.27%**	0: 3.37% 1: 3.42%
53	Model 1 + Education + Physical Activity + BMI + Race/Ethnicity + Treatment Type	0: HR=1.81 (1.02-3.19) 1: HR=1.46 (0.80-2.66) 2: HR=1.00 (REF) p=0.1246	46	n=305 d=77	**0: 19.87%** **1: 20.66%**	0: 1.63% **1: 11.45%**	0: 1.63% 1: 3.31%
54	Model 1 + Education + Physical Activity + BMI + Race/Ethnicity + Treatment Type + Comorbidities	0: HR=1.75 (0.98-3.12) 1: HR=1.44 (0.79-2.64) 2: HR=1.00 (REF) p=0.1618	46	n=305 d=77	**0: 15.89%** **1: 19.01%**	0: 4.89% 1: 9.92%	0: 3.31% 1: 1.37%
55	Model 1 + Education + Physical Activity + BMI + Race/Ethnicity + Treatment Type + Comorbidities + Current Lymphedema	0: HR=1.78 (1.00-3.17) 1: HR=1.46 (0.80-2.67) 2: HR=1.00 (REF) p=0.1471	46	n=305 d=77	**0: 17.88%** **1: 20.66%**	0: 3.26% **1: 11.45%**	0: 1.71% 1: 1.39%

Model	Variable(s) in model	Mental Component Summary Score (MCS) HR (95% CI)	Difference in 'N'	Total in model (n) and total dead (d)	% change from Crude	% change from model 1	% change from previous model
56	Model 1 + Education + Physical Activity + BMI + Race/Ethnicity + Treatment Type + Comorbidities + Current Lymphedema + Pessimism	0: HR=1.65 (0.92-2.96) 1: HR=1.43 (0.78-2.62) 2: HR=1.00 (REF) p=0.2391	46	n=305 d=77	0: 9.27% **1: 18.18%**	**0: 10.33%** 1: 9.16%	0: 7.30% 1: 2.05%
57	Model 1 + Education + Physical Activity + BMI + Race/Ethnicity + Treatment Type + Comorbidities + Current Lymphedema + Pessimism + Fear of Recurrence	0: HR=1.65 (0.92-2.97) 1: HR=1.43 (0.78-2.63) 2: HR=1.00 (REF) p=0.2384	46	n=305 d=77	0: 9.27% **1: 18.18%**	**0: 10.33%** 1: 9.16%	0: 0.00% 1: 0.00%
58	Model 1 + Education + Physical Activity + BMI + Race/Ethnicity + Treatment Type + Comorbidities + Current Lymphedema + Pessimism + Fear of Recurrence + Confide	0: HR=1.68 (0.93-3.05) 1: HR=1.44 (0.78-2.64) 2: HR=1.00 (REF) p=0.2213	46	n=305 d=77	**0: 11.26%** **1: 19.01%**	0: 8.70% 1: 9.92%	0: 1.82% 1: 0.70%
59	Model 1 + Education + Physical Activity + BMI + Race/Ethnicity + Treatment Type + Comorbidities + Current Lymphedema + Pessimism + Fear of Recurrence + Confide + Bodily Pain	0: HR=1.66 (0.91-3.03) 1: HR=1.43 (0.78-2.63) 2: HR=1.00 (REF) p=0.2449	46	n=305 d=77	0: 9.93% **1: 18.18%**	0: 9.78% 1: 9.16%	0: 1.19% 1: 0.69%
60	Model 1 + Education + Physical Activity + BMI + Race/Ethnicity + Treatment Type + Comorbidities + Current Lymphedema + Pessimism + Fear of Recurrence + Confide + Bodily Pain + Perceived General Health	0: HR=1.46 (0.79-2.71) 1: HR=1.35 (0.73-2.50) 2: HR=1.00 (REF) p=0.4553	46	n=305 d=77	0: 3.31% **1: 11.57%**	**0: 20.65%** 1: 3.05%	**0: 12.05%** 1: 5.59%

Appendix H. Physical Component Summary Score Univariate HR Analysis and Percent Change for Breast Cancer-Specific Mortality when Assessing for Potential Confounders (*N* = 351)

Model	Variable(s) in model	Categories	Total in categories (n)	Total in model (n); dead (d)	Missing	Univariate-Cox HR (95% CI)	p-values*	PCS HR (95% CI) and p-values	% change from crude model
Crude	Physical Component Summary Score (PCS)	0: ≤ 50.28 1: > 50.28 (REF)	0: 176 1: 175	n=351 d=26	0	0: HR=1.09 (0.51-2.36)	p=0.8239	0: HR=1.09 (0.51-2.36) p(PCS)=0.8239	--
1	Age	Continuous	--	n=351 d=26	0	HR=1.00 (0.97-1.04)	p=0.8950	0: HR=1.08 (0.49-2.37) p(PCS)=0.8473 p(Age)=0.8950	0: 0.92%
2	Race/Ethnicity	0: Non-Hispanic White (REF) 1: Hispanic	0: 273 1: 78	n=351 d=26	0	0: HR=1.00 1: HR=0.84 (0.32-2.23)	p=0.7292	0: HR=1.09 (0.51-2.36) p(PCS)=0.8230 p(Ethnicity)=0.7292	0: 0.00%
3	Marital Status	0: Single 1: Married (REF)	0: 160 1: 191	n=351 d=26	0	0: HR=1.10 (0.51-2.40) 1: HR=1.00	p=0.8040	0: HR=1.08 (0.50-2.34) p(PCS)=0.8454 p(Marital)=0.8040	0: 0.92%

Model	Variable(s) in model	Categories	Total in categories (n)	Total in model (n); dead (d)	Missing	Univariate-Cox HR (95% CI)	p-values*	PCS HR (95% CI) and p-values	% change from crude model
4	Tumor Stage	0: Localized (I) 1: Regional (II-IIIa)	0: 276 1: 75	n=351 d=26	0	0: HR=1.00 1: HR=2.75 (1.26-5.99)	**p=0.0110**	0: HR=1.14 (0.53-2.46) p(PCS)=0.7388 p(Stage)=0.0110	0: 4.59%
5	Breast Cancer Treatment Type	0: Surgery only (REF) 1: Any chemotherapy 2: Surgery and radiation	0: 98 1: 109 2: 144	n=351 d=26	0	0: HR=1.00 1: HR=6.83 (1.56-29.79) 2: HR=2.56 (0.54-12.04)	**p=0.0076**	0: HR=1.24 (0.57-2.68) p(PCS)=0.5852 p(Treatment1)=0.0106 p(Treatment2)=0.2354	**0: 13.76%**
6	Comorbidities	0: Zero (REF) 1: One or more	0: 298 1: 53	n=351 d=26	0	0: HR=1.00 1: HR=1.49 (0.55-4.01)	p=0.4335	0: HR=1.04 (0.47-2.27) p(PCS)=0.9274 p(Comorbidities)=0.4335	0: 4.59%
7	Current Lymphedema	0: No (REF) 1: Yes	0: 307 1: 44	n=351 d=26	0	0: HR=1.00 1: HR=0.83 (0.25-2.81)	p=0.7685	0: HR=1.11 (0.51-2.42) p(PCS)=0.7910 p(Lymphedema)=0.7685	0: 1.83%

Model	Variable(s) in model	Categories	Total in categories (n)	Total in model (n); dead (d)	Missing	Univariate-Cox HR (95% CI)	p-values*	PCS HR (95% CI) and p-values	% change from crude model
8	Perceived Optimism	0: ≤ 10 1: > 10 (REF)	0: 83 1: 268	n=351 d=26	0	0: HR=0.62 (0.21-1.81) 1: HR=1.00	p=0.3819	0: HR=1.15 (0.53-2.49) p(PCS)=0.7299 p(Optimism)=0.3819	0: 5.50%
9	Perceived Pessimism	0: ≤ 10 (REF) 1: > 10	0: 255 1: 96	n=351 d=26	0	0: HR=1.00 1: HR=1.55 (0.68-3.54)	p=0.2970	0: HR=1.01 (0.46-2.21) p(PCS)=0.9825 p(Pessimism)=0.2970	0: 7.34%
10	Number of Types of Confidants	0: < 3 1: 4-5 2: > 5 (REF)	0: 66 1: 172 2: 113	n=351 d=26	0	0: HR=0.30 (0.07-1.35) 1: HR=0.67 (0.30-1.49) 2: HR=1.00	**p=0.2463**	0: HR=1.07 (0.49-2.31) p(PCS)=0.8670 p(Confidant0)=0.1174 p(Confidant1)=0.3220	0: 1.83%
11	Fear of Recurrence	0: No (REF) 1: Yes	0: 154 1: 197	n=351 d=26	0	0: HR=1.00 1: HR=1.43 (0.64-3.21)	p=0.3862	0: HR=1.10 (0.51-2.38) p(PCS)=0.8047 p(Fear)=0.3862	0: 0.92%

Model	Variable(s) in model	Categories	Total in categories (n)	Total in model (n); dead (d)	Missing	Univariate-Cox HR (95% CI)	p-values*	PCS HR (95% CI) and p-values	% change from crude model
Crude	PCS (restricted to those with education)		0: 175 1: 175	n=350 d=26		0: HR=1.09 (0.51-2.36)	p=0.8183	0: HR=1.09 (0.51-2.36) p(PCS)=0.8183	--
12	Education	0: High school or less 1: Some college 2: College graduate 3: Graduate school (REF)	0: 92 1: 114 2: 70 3: 74	n=350 d=26	1	0: HR=1.36 (0.48-3.85) 1: HR=1.10 (0.39-3.05) 2: HR=0.17 (0.02-1.44) 3: HR=1.00	p=0.2800	0: HR=0.99 (0.45-2.15) p(PCS)=0.9735 p(Education0)=0.5647 p(Education1)=0.8616 p(Education2)=0.1047	0: 9.17%
Crude	PCS (restricted to those with tumor size)		0: 173 1: 168	n=341 d=26		0: HR=1.07 (0.50-2.31)	p=0.8631	0: HR=1.07 (0.50-2.31) p(PCS)=0.8631	--
13	Tumor Size	0: < 3 cm (REF) 1: ≥ 3 cm	0: 304 1: 37	n=341 d=26	10	0: HR=1.00 1: HR=3.88 (1.69-8.94)	**p=0.0014**	0: HR=1.11 (0.51-2.39) p(PCS)=0.7997 p(Size)=0.0014	0: 3.74%

Model	Variable(s) in model	Categories	Total in categories (n)	Total in model (n); dead (d)	Missing	Univariate-Cox HR (95% CI)	p-values*	PCS HR (95% CI) and p-values	% change from crude model
Crude	PCS (restricted to those with lymph node involvement)		0: 170 1: 171	n=341 d=24		0: HR=0.94 (0.42-2.09)	p=0.8715	0: HR=0.94 (0.42-2.09) p(PCS)=0.8715	--
14	Lymph Node Involvement	0: None (REF) 1: ≥ 1 lymph node involved	0: 264 1: 77	n=341 d=24	10	0: HR=1.00 1: HR=2.97 (0.83-2.10)	**p=0.0080**	0: HR=0.99 (0.44-2.22) p(PCS)=0.9865 p(Lymph node)=0.0080	0: 5.32%
Crude	PCS (restricted to those with Tamoxifen use, smoking status, and physical activity)		0: 165 1: 165	n=330 d=24		0: HR=1.31 (0.59-2.93)	p=0.5088	0: HR=1.31 (0.59-2.93) p(PCS)=0.5088	--
15	Tamoxifen Use	0: No 1: Yes (REF)	0: 160 1: 170	n=330 d=24	21	0: HR=0.88 (0.39-1.97) 1: HR=1.00	p=0.7580	0: HR=1.32 (0.59-2.95) p(PCS)=0.4990 p(Tamoxifen)=0.7580	0: 0.76%

Model	Variable(s) in model	Categories	Total in categories (n)	Total in model (n); dead (d)	Missing	Univariate-Cox HR (95% CI)	p-values*	PCS HR (95% CI) and p-values	% change from crude model
16	Smoking Status	0: Never (REF) 1: Former 2: Current	0: 145 1: 144 2: 41	n=330 d=24	21	0: HR=1.00 1: HR=0.91 (0.37-2.23) 2: HR=1.86 (0.63-5.44)	p=0.4113	0: HR=1.24 (0.55-2.79) p(PCS)=0.6020 p(Smoker1)=0.8280 p(Smoker2)=0.2600	0: 5.34%
17	Physical Activity	0: None 1: Low 2: Moderate/Vigorous (REF)	0: 185 1: 59 2: 86	n=330 d=24	21	0: HR=1.27 (0.44-3.60) 1: HR=1.64 (0.49-5.44) 2: HR=1.00	p=0.7216	0: HR=1.25 (0.55-2.82) p(PCS)=0.5970 p(PA0)=0.6600 p(PA1)=0.4222	0: 4.58%
Crude	PCS (restricted to those with BMI)		0: 161 1: 163	n=324 d=24		0: HR=1.09 (0.49-2.42)	p=0.8385	0: HR=1.09 (0.49-2.42) p(PCS)=0.8385	--
18	Body Mass Index (BMI)	0: <25 (REF) 1: 25-29 2: ≥30	0: 161 1: 99 2: 64	n=324 d=24	27	0: HR=1.00 1: HR=1.77 (0.72-4.39) 2: HR=1.48 (0.49-4.45)	p=0.4574	0: HR=1.02 (0.45-2.28) p(PCS)=0.9684 p(BMI1)=0.2149 p(BMI2)=0.4887	0: 6.42%

Model	Variable(s) in model	Categories	Total in categories (n)	Total in model (n); dead (d)	Missing	Univariate-Cox HR (95% CI)	p-values*	PCS HR (95% CI) and p-values	% change from crude model
Crude	PCS (restricted to those tumor subtype)		0: 155 1: 145	n=300 d=22		0: HR=1.02 (0.44-2.35)	p=0.9667	0: HR=1.02 (0.44-2.35) p(PCS)=0.9667	--
19	Tumor Subtype	0: ER+ (REF) 1: ER-	0: 251 1: 49	n=300 d=22	51	0: HR=1.00 1: HR=1.55 (0.57-4.19)	p=0.3926	0: HR=1.02 (0.44-2.35) p(PCS)=0.9659 p(Subtype)=0.3926	0: 0.00%

*Bolded p-values are <0.25.

Appendix I. Mental Component Summary Score Univariate HR Analysis and Percent Change for Breast Cancer-Specific Mortality when Assessing for Potential Confounders (*N* = 351)

Model	Variable(s) in model	Categories	Total in categories (n)	Total in model (n); dead (d)	Missing	Univariate-Cox HR (95% CI)	p-values*	MCS HR (95% CI) and p-values	% change from crude model
Crude	Mental Component Summary Score (MCS)	0: ≤ 50.70 1: > 50.70 (REF)	0: 176 1: 175	n=351 d=26	0	0: HR=1.22 (0.57-2.65)	p=0.6082	0: HR=1.22 (0.57-2.65) p(MCS)=0.6082	--
1	Age	Continuous	--	n=351 d=26	0	HR=1.00 (0.97-1.04)	p=0.8186	0: HR=1.24 (0.57-2.68) p(MCS)=0.5928 p(Age)=0.8186	0: 1.64%
2	Race/Ethnicity	0: Non-Hispanic White (REF) 1: Hispanic	0: 273 1: 78	n=351 d=26	0	0: HR=1.00 1: HR=0.83 (0.31-2.20)	p=0.7047	0: HR=1.24 (0.57-2.68) p(MCS)=0.5910 p(Ethnicity)=0.7047	0: 1.64%
3	Marital Status	0: Single 1: Married (REF)	0: 160 1: 191	n=351 d=26	0	0: HR=1.11 (0.51-2.40) 1: HR=1.00	p=0.7902	0: HR=1.22 (0.57-2.64) p(MCS)=0.6094 p(Marital)=0.7902	0: 0.00%

Model	Variable(s) in model	Categories	Total in categories (n)	Total in model (n); dead (d)	Missing	Univariate-Cox HR (95% CI)	p-values*	MCS HR (95% CI) and p-values	% change from crude model
4	Tumor Stage	0: Localized (I) 1: Regional (II-IIIa)	0: 276 1: 75	n=351 d=26	0	0: HR=1.00 1: HR=2.77 (1.27-6.05)	**p=0.0104**	0: HR=1.29 (0.60-2.80) p(MCS)=0.5165 p(Stage)=0.0104	0: 5.74%
5	Breast Cancer Treatment Type	0: Surgery only (REF) 1: Any chemotherapy 2: Surgery and radiation	0: 98 1: 109 2: 144	n=351 d=26	0	0: HR=1.00 1: HR=6.61 (1.52-28.74) 2: HR=2.54 (0.54-11.97)	**p=0.0092**	0: HR=1.14 (0.53-2.47) p(MCS)=0.2111 p(Treatment1)=0.0119 p(Treatment2)=0.2383	0: 6.56%
6	Comorbidities	0: Zero (REF) 1: One or more	0: 298 1: 53	n=351 d=26	0	0: HR=1.00 1: HR=1.45 (0.54-3.90)	p=0.4574	0: HR=1.18 (0.54-2.57) p(MCS)=0.6824 p(Comorbidities)=0.4574	0: 3.28%
7	Current Lymphedema	0: No (REF) 1: Yes	0: 307 1: 44	n=351 d=26	0	0: HR=1.00 1: HR=0.84 (0.25-2.79)	p=0.7688	0: HR=1.23 (0.57-2.67) p(MCS)=0.5942 p(Lymphedema)=0.7688	0: 0.82%

Model	Variable(s) in model	Categories	Total in categories (n)	Total in model (n); dead (d)	Missing	Univariate-Cox HR (95% CI)	p-values*	MCS HR (95% CI) and p-values	% change from crude model
8	Perceived Optimism	0: ≤ 10 1: > 10 (REF)	0: 83 1: 268	n=351 d=26	0	0: HR=0.60 (0.20-1.75) 1: HR=1.00	p=0.3460	0: HR=1.32 (0.60-2.88) p(MCS)=0.4909 p(Optimism)=0.3460	0: 8.20%
9	Perceived Pessimism	0: ≤ 10 (REF) 1: > 10	0: 255 1: 96	n=351 d=26	0	0: HR=1.00 1: HR=1.51 (0.66-3.46)	p=0.3280	0: HR=1.13 (0.51-2.49) p(MCS)=0.7593 p(Pessimism)=0.3280	0: 7.38%
10	Current Fatigue	0: No (REF) 1: Yes	0: 136 1: 215	n=351 d=26	0	0: HR=1.00 1: HR=0.75 (0.55-1.35)	p=0.5085	0: HR=1.36 (0.59-3.12) p(MCS)=0.4728 p(Fatigue)=0.5085	**0: 11.48%**
11	Fear of Recurrence	0: No (REF) 1: Yes	0: 154 1: 197	n=351 d=26	0	0: HR=1.00 1: HR=1.39 (0.61-3.15)	p=0.4284	0: HR=1.16 (0.53-2.54) p(MCS)=0.7029 p(Fear)=0.4284	0: 4.92%

Model	Variable(s) in model	Categories	Total in categories (n)	Total in model (n); dead (d)	Missing	Univariate-Cox HR (95% CI)	p-values*	MCS HR (95% CI) and p-values	% change from crude model
12	Number of Types of Confidants	0: < 3 1: 4-5 2: > 5 (REF)	0: 66 1: 172 2: 113	n=351 d=26	0	0: HR=0.30 (0.07-1.32) 1: HR=0.65 (0.29-1.46) 2: HR=1.00	**p=0.2284**	0: HR=1.28 (0.59-2.78) p(MCS)=0.5283 p(Confidant0)=0.1105 p(Confidant1)=0.2964	0: 4.92%
13	Bodily Pain	0: No Pain 1: Experienced Pain (REF)	0: 180 1: 171	n=351 d=26	0	0: HR=1.00 1: HR=1.20 (0.48-3.02)	p=0.6965	0: HR=1.20 (0.55-2.61) p(MCS)=0.6517 p(Pain)=0.6965	0: 1.64%
14	Perceived General Health	0: "Poor" & "Fair" 1: "Good", "Very Good", & "Excellent" (REF)	0: 54 1: 297	n=351 d=26	0	0: HR=1.42 (0.52-3.83) 1: HR=1.00	p=0.4930	0: HR=1.17 (0.53-2.56) p(MCS)=0.7027 p(Health)=0.4930	0: 4.10%
Crude	MCS (restricted to those with education)		0: 176 1: 174	n=350 d=26		0: HR=1.22 (0.56-2.64)	p=0.6131	0: HR=1.22 (0.56-2.64) p(MCS)=0.6131	--

Model	Variable(s) in model	Categories	Total in categories (n)	Total in model (n); dead (d)	Missing	Univariate-Cox HR (95% CI)	p-values*	MCS HR (95% CI) and p-values	% change from crude model
15	Education	0: High school or less 1: Some college 2: College graduate 3: Graduate school (REF)	0: 92 1: 114 2: 70 3: 74	n=350 d=26	1	0: HR=1.37 (0.49-3.85) 1: HR=1.09 (0.40-3.01) 2: HR=0.18 (0.02-1.48) 3: HR=1.00	p=0.2833	0: HR=1.12 (0.52-2.42) p(MCS)=0.7803 p(Education0)=0.5539 p(Education1)=0.8640 p(Education2)=0.1095	0: 8.20%
Crude	MCS (restricted to those with tumor size)		0: 170 1: 171	n=341 d=26		0: HR=1.24 (0.58-2.69)	p=0.5804	0: HR=1.24 (0.58-2.69) p(MCS)=0.5804	--
16	Tumor Size	0: < 3 cm (REF) 1: ≥ 3 cm	0: 304 1: 37	n=341 d=26	10	0: HR=1.00 1: HR=3.88 (1.69-8.93)	**p=0.0014**	0: HR=1.26 (0.58-2.72) p(MCS)=0.5608 p(Size)=0.0014	0: 1.61%
Crude	MCS (restricted to those with lymph node involvement)		0: 170 1: 171	n=341 d=24		0: HR=1.05 (0.47-2.33)	p=0.9126	0: HR=1.05 (0.47-2.33) p(MCS)=0.9126	--

Model	Variable(s) in model	Categories	Total in categories (n)	Total in model (n); dead (d)	Missing	Univariate-Cox HR (95% CI)	p-values*	MCS HR (95% CI) and p-values	% change from crude model
17	Lymph Node Involvement	0: None (REF) 1: ≥ 1 lymph node involved	0: 264 1: 77	n=341 d=24	10	0: HR=1.00 1: HR=2.98 (1.34-6.66)	**p=0.0077**	0: HR=1.09 (0.49-2.44) p(MCS)=0.8264 p(Lymph node)=0.0077	0: 3.81%
Crude	MCS (restricted to those with Tamoxifen use, smoking status, and physical activity)		0: 165 1: 165	n=330 d=24		0: HR=1.26 (0.56-2.81)	p=0.5772	0: HR=1.26 (0.56-2.81) p(MCS)=0.5772	--
18	Tamoxifen Use	0: No 1: Yes (REF)	0: 160 1: 170	n=330 d=24	21	0: HR=0.89 (0.40-1.99) 1: HR=1.00	p=0.7758	0: HR=1.26 (0.56-2.81) p(MCS)=0.5732 p(Tamoxifen)=0.7758	0: 0.00%
19	Smoking Status	0: Never (REF) 1: Former 2: Current	0: 145 1: 144 2: 41	n=330 d=24	21	0: HR=1.00 1: HR=0.88 (0.36-2.17) 2: HR=1.84 (0.62-5.42)	p=0.3991	0: HR=1.21 (0.54-2.71) p(MCS)=0.6497 p(Smoker1)=0.7795 p(Smoker2)=0.2698	0: 3.97%

Model	Variable(s) in model	Categories	Total in categories (n)	Total in model (n); dead (d)	Missing	Univariate-Cox HR (95% CI)	p-values*	MCS HR (95% CI) and p-values	% change from crude model
20	Physical Activity	0: None 1: Low 2: Moderate/Vigorous (REF)	0: 185 1: 59 2: 86	n=330 d=24	21	0: HR=1.37 (0.49-3.87) 1: HR=1.76 (0.54-5.78) 2: HR=1.00	p=0.6484	0: HR=1.29 (0.58-2.90) p(MCS)=0.5332 p(PA0)=0.5499 p(PA1)=0.3520	0: 2.38%
Crude	MCS (restricted to those with BMI)		0: 167 1: 157	n=324 d=24		0: HR=1.40 (0.62-3.16)	p=0.4144	0: HR=1.40 (0.62-3.16) p(MCS)=0.4144	--
21	Body Mass Index (BMI)	0: <25 (REF) 1: 25-29 2: ≥30	0: 161 1: 99 2: 64	n=324 d=24	27	0: HR=1.00 1: HR=1.75 (0.71-4.31) 2: HR=1.46 (0.49-4.35)	p=0.4729	0: HR=1.36 (0.61-3.08) p(MCS)=0.4539 p(BMI1)=0.2250 p(BMI2)=0.5021	0: 2.86%
Crude	MCS (restricted to those tumor subtype)		0: 150 1: 150	n=300 d=22		0: HR=1.05 (0.45-2.42)	p=0.9132	0: HR=1.05 (0.45-2.42) p(MCS)=0.9132	--

Model	Variable(s) in model	Categories	Total in categories (n)	Total in model (n); dead (d)	Missing	Univariate-Cox HR (95% CI)	p-values*	MCS HR (95% CI) and p-values	% change from crude model
22	Tumor Subtype	0: ER+ (REF) 1: ER-	0: 251 1: 49	n=300 d=22	51	0: HR=1.00 1: HR=1.54 (0.57-4.18)	p=0.3945	0: HR=1.04 (0.45-2.39) p(MCS)=0.9342 p(Subtype)=0.3945	0: 0.95%

*Bolded p-values are <0.25.

Appendix J. Physical Component Summary Score Univariate HR Analysis and Percent Change for Non-Cancer Mortality when Assessing for Potential Confounders (*N* = 351)

Model	Variable(s) in model	Categories	Total in categories (n)	Total in model (n); dead (d)	Missing	Univariate-Cox HR (95% CI)	p-values*	PCS HR (95% CI) and p-values	% change from crude model
Crude	Physical Component Summary Score (PCS)	0: ≤ 44.75 1: > 44.75 & ≤ 54.39 2: > 54.39 (REF)	0: 117 1: 117 2: 117	n=351 d=64	0	0: HR=5.63 (2.74-11.55) 1: HR=1.41 (0.59-3.35)	**p=<0.0001**	0: HR=5.63 (2.74-11.55) p(PCS)=<0.0001 1: HR=1.41 (0.59-3.35) p(PCS)=0.4366	--
1	Age	Continuous	--	n=351 d=64	0	HR=1.10 (1.07-1.13)	**p=<0.0001**	0: HR=2.71 (1.28-5.74) p(PCS)=0.0090 1: HR=0.92 (0.38-2.27) p(PCS)=0.8539 p(Age)=<0.0001	**0: 51.87%** **1: 34.75%**
2	Race/Ethnicity	0: Non-Hispanic White (REF) 1: Hispanic	0: 273 1: 78	n=351 d=64	0	0: HR=1.00 1: HR=0.55 (0.27-1.11)	**p=0.0941**	0: HR=5.63 (2.74-11.57) p(PCS)=<0.0001 1: HR=1.41 (0.59-3.34) p(PCS)=0.0944 p(Ethnicity)=0.0941	0: 0.00% 1: 0.00%
3	Marital Status	0: Single 1: Married (REF)	0: 160 1: 191	n=351 d=64	0	0: HR=2.23 (1.32-3.77) 1: HR=1.00	**p=0.0028**	0: HR=5.10 (2.48-10.49) p(PCS)=<0.0001 1: HR=1.39 (0.59-3.31) p(PCS)=0.4514 p(Marital)=0.0028	0: 9.41% 1: 1.42%

Model	Variable(s) in model	Categories	Total in categories (n)	Total in model (n); dead (d)	Missing	Univariate-Cox HR (95% CI)	p-values*	PCS HR (95% CI) and p-values	% change from crude model
4	Tumor Stage	0: Localized (I) 1: Regional (II-IIIa)	0: 276 1: 75	n=351 d=64	0	0: HR=1.00 1: HR=0.81 (0.42-1.55)	p=0.5227	0: HR=5.58 (2.72-11.45) p(PCS)=<0.0001 1: HR=1.40 (0.59-3.32) p(PCS)=0.4485 p(Stage)=0.5227	0: 0.89% 1: 0.71%
5	Breast Cancer Treatment Type	0: Surgery only (REF) 1: Any chemotherapy 2: Surgery and radiation	0: 98 1: 109 2: 144	n=351 d=64	0	0: HR=1.00 1: HR=0.43 (0.21-0.87) 2: HR=0.69 (0.40-1.19)	**p=0.0556**	0: HR=5.31 (2.58-10.92) p(PCS)=<0.0001 1: HR=1.39 (0.58-3.29) p(PCS)=0.4594 p(Treatment1)=0.0181 p(Treatment2)=0.1819	0: 5.68% 1: 1.42%
6	Comorbidities	0: Zero (REF) 1: One or more	0: 298 1: 53	n=351 d=64	0	0: HR=1.00 1: HR=1.31 (0.72-2.40)	p=0.3799	0: HR=5.36 (2.58-11.11) p(PCS)=<0.0001 1: HR=1.38 (0.58-3.27) p(PCS)=0.4704 p(Comorbidities)=0.3799	0: 4.80% 1: 2.13%
7	Current Lymphedema	0: No (REF) 1: Yes	0: 307 1: 44	n=351 d=64	0	0: HR=1.00 1: HR=0.48 (0.21-1.12)	**p=0.0875**	0: HR=6.09 (2.96-12.54) p(PCS)=<0.0001 1: HR=1.47 (0.62-3.49) p(PCS)=0.3823 p(Lymphedema)=0.0875	0: 8.17% 1: 4.26%

Model	Variable(s) in model	Categories	Total in categories (n)	Total in model (n); dead (d)	Missing	Univariate-Cox HR (95% CI)	p-values*	PCS HR (95% CI) and p-values	% change from crude model
8	Perceived Optimism	0: ≤ 10 1: > 10 (REF)	0: 83 1: 268	n=351 d=64	0	0: HR=1.50 (0.90-2.53) 1: HR=1.00	**p=0.1227**	0: HR=5.09 (2.44-10.58) p(PCS)=<0.0001 1: HR=1.36 (0.57-3.23) p(PCS)=0.4895 p(Optimism)=0.1227	0: 9.59% 1: 3.55%
9	Perceived Pessimism	0: ≤ 10 (REF) 1: > 10	0: 255 1: 96	n=351 d=64	0	0: HR=1.00 1: HR=1.39 (0.83-2.33)	**p=0.2062**	0: HR=5.26 (2.54-10.89) p(PCS)=<0.0001 1: HR=1.38 (0.58-3.28) p(PCS)=0.4664 p(Pessimism)=0.2062	0: 6.57% 1: 2.13%
10	Number of Types of Confidants	0: < 3 1: 4-5 2: > 5 (REF)	0: 66 1: 172 2: 113	n=351 d=64	0	0: HR=2.85 (1.41-5.74) 1: HR=1.67 (0.87-3.20) 2: HR=1.00	**p=0.0123**	0: HR=5.77 (2.81-11.86) p(PCS)=<0.0001 1: HR=1.50 (0.63-3.57) p(PCS)=0.3575 p(Confidant0)=0.0034 p(Confidant1)=0.1212	0: 2.49% 1: 6.38%
11	Fear of Recurrence	0: No (REF) 1: Yes	0: 154 1: 197	n=351 d=64	0	0: HR=1.00 1: HR=0.49 (0.30-0.81)	**p=0.0053**	0: HR=5.63 (2.74-11.56) p(PCS)=<0.0001 1: HR=1.43 (0.60-3.39) p(PCS)=0.4191 p(Fear)=0.0053	0: 0.00% 1: 1.42%

Model	Variable(s) in model	Categories	Total in categories (n)	Total in model (n); dead (d)	Missing	Univariate-Cox HR (95% CI)	p-values*	PCS HR (95% CI) and p-values	% change from crude model
Crude	PCS (restricted to those with education)		0: 116 1: 117 2: 117	n=350 d=63		0: HR=5.51 (2.68-11.33) 1: HR=1.41 (0.59-3.35)	**p=<0.0001**	0: HR=5.51 (2.68-11.33) p(PCS)=<0.0001 1: HR=1.41 (0.59-3.35) p(PCS)=0.4365	--
12	Education	0: High school or less 1: Some college 2: College graduate 3: Graduate school (REF)	0: 92 1: 114 2: 70 3: 74	n=350 d=63	1	0: HR=2.50 (1.05-5.94) 1: HR=1.73 (0.74-4.04) 2: HR=2.05 (0.81-5.22) 3: HR=1.00	**p=0.2047**	0: HR=5.34 (2.56-11.12) p(PCS)=<0.0001 1: HR=1.33 (0.56-3.17) p(PCS)=0.5231 p(Education0)=0.0386 p(Education1)=0.2037 p(Education2)=0.1319	0: 3.09% 1: 5.67%
Crude	PCS (restricted to those with tumor size)		0: 116 1: 114 2: 111	n=341 d=64		0: HR=5.43 (2.64-11.14) 1: HR=1.39 (0.59-3.30)	**p=<0.0001**	0: HR=5.43 (2.64-11.14) p(PCS)=<0.0001 1: HR=1.39 (0.59-3.30) p(PCS)=0.4544	--
13	Tumor Size	0: < 3 cm (REF) 1: ≥ 3 cm	0: 304 1: 37	n=341 d=64	10	0: HR=1.00 1: HR=0.45 (0.14-1.45)	**p=0.1828**	0: HR=5.44 (2.65-11.16) p(PCS)=<0.0001 1: HR=1.42 (0.60-3.38) p(PCS)=0.4238 p(Size)=0.1828	0: 0.18% 1: 4.51%

Model	Variable(s) in model	Categories	Total in categories (n)	Total in model (n); dead (d)	Missing	Univariate-Cox HR (95% CI)	p-values*	PCS HR (95% CI) and p-values	% change from crude model
Crude	PCS (restricted to those with lymph node involvement)		0: 113 1: 112 2: 116	n=341 d=59		0: HR=6.29 (2.95-13.41) 1: HR=1.36 (0.54-3.45)	**p=<0.0001**	0: HR=6.29 (2.95-13.41) p(PCS)=<0.0001 1: HR=1.36 (0.54-3.45) p(PCS)=0.5161	--
14	Lymph Node Involvement	0: None (REF) 1: ≥ 1 lymph node involved	0: 264 1: 77	n=341 d=59	10	0: HR=1.00 1: HR=0.86 (0.45-1.66)	p=0.6606	0: HR=6.25 (2.93-13.34) p(PCS)=<0.0001 1: HR=1.36 (0.53-3.43) p(PCS)=0.5225 p(Lymph node)=0.6606	0: 0.64% 1: 0.00%
Crude	PCS (restricted to those with Tamoxifen use, smoking status, and physical activity)		0: 107 1: 110 2: 113	n=330 d=59		0: HR=5.19 (2.51-10.74) 1: HR=1.42 (0.60-3.37)	**p=<0.0001**	0: HR=5.19 (2.51-10.74) p(PCS)=<0.0001 1: HR=1.42 (0.60-3.37) p(PCS)=0.4276	--
15	Tamoxifen Use	0: No 1: Yes (REF)	0: 160 1: 170	n=330 d=59	21	0: HR=1.36 (0.81-2.26) 1: HR=1.00	**p=0.2465**	0: HR=5.22 (2.52-10.81) p(PCS)=<0.0001 1: HR=1.39 (0.59-3.31) p(PCS)=0.4522 p(Tamoxifen)=0.2465	0: 0.58% 1: 2.11%

Model	Variable(s) in model	Categories	Total in categories (n)	Total in model (n); dead (d)	Missing	Univariate-Cox HR (95% CI)	p-values*	PCS HR (95% CI) and p-values	% change from crude model
16	Smoking Status	0: Never (REF) 1: Former 2: Current	0: 145 1: 144 2: 41	n=330 d=59	21	0: HR=1.00 1: HR=1.07 (0.62-1.86) 2: HR=1.20 (0.54-2.67)	p=0.8981	0: HR=5.16 (2.49-10.70) p(PCS)=<0.0001 1: HR=1.41 (0.59-3.34) p(PCS)=0.4393 p(Smoker1)=0.7983 p(Smoker2)=0.6515	0: 0.58% 1: 0.70%
17	Physical Activity	0: None 1: Low 2: Moderate/Vigorous (REF)	0: 185 1: 59 2: 86	n=330 d=59	21	0: HR=1.51 (0.77-2.97) 1: HR=0.37 (0.12-1.81) 2: HR=1.00	**p=0.0191**	0: HR=4.99 (2.38-10.48) p(PCS)=<0.0001 1: HR=1.35 (0.57-3.23) p(PCS)=0.4965 p(PA0)=0.2314 p(PA1)=0.0936	0: 3.85% 1: 4.93%
Crude	PCS (restricted to those with BMI)		0: 106 1: 110 2: 108	n=324 d=54		0: HR=5.09 (2.36-10.99) 1: HR=1.41 (0.57-3.51)	**p=<0.0001**	0: HR=5.09 (2.36-10.99) p(PCS)=<0.0001 1: HR=1.41 (0.57-3.51) p(PCS)=0.4585	--

Model	Variable(s) in model	Categories	Total in categories (n)	Total in model (n); dead (d)	Missing	Univariate-Cox HR (95% CI)	p-values*	PCS HR (95% CI) and p-values	% change from crude model
18	Body Mass Index (BMI)	0: <25 (REF) 1: 25-29 2: ≥30	0: 161 1: 99 2: 64	n=324 d=54	27	0: HR=1.00 1: HR=0.51 (0.25-1.04) 2: HR=1.03 (0.54-1.95)	**p=0.1354**	0: HR=5.25 (2.40-11.49) p(PCS)=<0.0001 1: HR=1.46 (0.58-3.64) p(PCS)=0.4199 p(BMI1)=0.0622 p(BMI2)=0.9382	0: 3.14% 1: 3.55%
Crude	PCS (restricted to those tumor subtype)		0: 102 1: 101 2: 97	n=300 d=56		0: HR=4.43 (2.13-9.20) 1: HR=1.27 (0.53-3.07)	**p=<0.0001**	0: HR=4.43 (2.13-9.20) p(PCS)=<0.0001 1: HR=1.27 (0.53-3.07) p(PCS)=0.5912	--
19	Tumor Subtype	0: ER+ (REF) 1: ER-	0: 251 1: 49	n=300 d=56	51	0: HR=1.00 1: HR=1.47 (0.76-2.85)	p=0.2578	0: HR=4.53 (2.18-9.43) p(PCS)=<0.0001 1: HR=1.27 (0.53-3.06) p(PCS)=0.5963 p(Subtype)=0.2578	0: 2.26% 1: 0.00%

*Bolded p-values are <0.25.

Appendix K. Percent Change from Crude and Model 1 with Each Potential Confounder (PCS & Non-Cancer Mortality) (*N* = 351)

Model	Variable(s) in model	Physical Component Summary Score (PCS) HR (95% CI)	Difference in 'N'	Total in model (n) and total dead (d)	% change from Crude	% change from model 1
Dataset restricted to those diagnosed with invasive breast cancer who have HRQOL and baseline covariates data						
Crude	Physical Component Summary Score (PCS)	0: HR=5.63 (2.74-11.55) 1: HR=1.41 (0.59-3.35) 2: HR=1.00 (REF) p=<0.0001	0	n=351 d=64	--	--
1	Age, Marital Status, & Tumor Size	0: HR=2.53 (1.19-5.40) 1: HR=0.91 (0.38-2.19) 2: HR=1.00 (REF) p=0.0016	0	n=351 d=64	**0: 55.06%** **1: 35.46%**	--
2	Model 1 + Race/Ethnicity	0: HR=2.53 (1.18-5.39) 1: HR=0.90 (0.37-2.18) 2: HR=1.00 (REF) p=0.0016	0	n=351 d=64	**0: 55.06%** **1: 36.17%**	0: 0.00% 1: 1.10%
3	Model 1 + Treatment Type	0: HR=2.51 (1.18-5.35) 1: HR=0.87 (0.36-2.11) 2: HR=1.00 (REF) p=0.0013	0	n=351 d=64	**0: 55.42%** **1: 38.30%**	0: 0.79% 1: 4.40%

Model	Variable(s) in model	Physical Component Summary Score (PCS) HR (95% CI)	Difference in 'N'	Total in model (n) and total dead (d)	% change from Crude	% change from model 1
4	Model 1 + Comorbidities	0: HR=2.50 (1.16-5.37) 1: HR=0.90 (0.37-2.18) 2: HR=1.00 (REF) p=0.0024	0	n=351 d=64	**0: 55.60%** **1: 36.17%**	0: 1.19% 1: 1.10%
5	Model 1 + Current Lymphedema	0: HR=2.62 (1.22-5.64) 1: HR=0.92 (0.38-2.23) 2: HR=1.00 (REF) p=0.0014	0	n=351 d=64	**0: 53.46%** **1: 34.75%**	0: 3.56% 1: 1.10%
6	Model 1 + Optimism	0: HR=2.40 (1.20-5.14) 1: HR=0.88 (0.36-2.14) 2: HR=1.00 (REF) p=0.0028	0	n=351 d=64	**0: 57.37%** **1: 37.59%**	0: 5.14% 1: 3.30%
7	Model 1 + Pessimism	0: HR=2.48 (1.17-5.26) 1: HR=0.97 (0.40-2.35) 2: HR=1.00 (REF) p=0.0042	0	n=351 d=64	**0: 55.95%** **1: 31.21%**	0: 1.98% 1: 6.59%
8	Model 1 + Number of Types of Confidants	0: HR=2.62 (1.23-5.59) 1: HR=0.96 (0.40-2.32) 2: HR=1.00 (REF) p=0.0017	0	n=351 d=64	**0: 53.46%** **1: 31.91%**	0: 3.56% 1: 5.49%

Model	Variable(s) in model	Physical Component Summary Score (PCS) HR (95% CI)	Difference in 'N'	Total in model (n) and total dead (d)	% change from Crude	% change from model 1
9	Model 1 + Fear of Recurrence	0: HR=2.58 (1.21-5.51) 1: HR=0.91 (0.38-2.20) 2: HR=1.00 (REF) p=0.0013	0	n=351 d=64	**0: 54.17%** **1: 35.46%**	0: 1.98% 1: 0.00%
Subset--Restricted to participants with Education variable						
Crude	Physical Component Summary Score (PCS)	0: HR=5.51 (2.68-11.33) 1: HR=1.41 (0.59-3.35) 2: HR=1.00 (REF) p=<0.0001	1	n=350 d=63	--	--
1	Age, Marital Status, & Tumor Stage	0: HR=2.48 (1.16-5.29) 1: HR=0.90 (0.37-2.17) 2: HR=1.00 (REF) p=0.0022	1	n=350 d=63	**0: 54.99%** **1: 36.17%**	--
10	Model 1 + Education	0: HR=2.59 (1.21-5.54) 1: HR=0.90 (0.37-2.17) 2: HR=1.00 (REF) p=0.0016	1	n=350 d=63	**0: 52.99%** **1: 36.17%**	0: 4.44% 1: 0.00%
Subset--Restricted to participants with the Tumor Size variable						

Model	Variable(s) in model	Physical Component Summary Score (PCS) HR (95% CI)	Difference in 'N'	Total in model (n) and total dead (d)	% change from Crude	% change from model 1
Crude	Physical Component Summary Score (PCS)	0: HR=5.43 (2.64-11.14) 1: HR=1.39 (0.59-3.30) 2: HR=1.00 (REF) p=<0.0001	10	n=341 d=64	--	--
1	Age, Marital Status, & Tumor Stage	0: HR=2.53 (1.19-5.39) 1: HR=0.92 (0.38-2.22) 2: HR=1.00 (REF) p=0.0018	10	n=341 d=64	**0: 53.41%** **1: 33.81%**	--
11	Model 1 + Tumor Size	0: HR=2.53 (1.19-5.39) 1: HR=0.91 (0.38-2.21) 2: HR=1.00 (REF) p=0.0018	10	n=341 d=64	**0: 53.41%** **1: 34.53%**	0: 0.00% 1: 1.09%
Subset--Restricted to participants with Lymph Node Involvement variable						
Crude	Physical Component Summary Score (PCS)	0: HR=6.29 (2.95-13.41) 1: HR=1.36 (0.54-3.45) 2: HR=1.00 (REF) p=<0.0001	10	n=341 d=59	--	--

Model	Variable(s) in model	Physical Component Summary Score (PCS) HR (95% CI)	Difference in 'N'	Total in model (n) and total dead (d)	% change from Crude	% change from model 1
1	Age, Marital Status, & Tumor Stage	0: HR=2.71 (1.22-6.02) 1: HR=0.96 (0.38-2.46) 2: HR=1.00 (REF) p=0.0029	10	n=341 d=59	**0: 56.92%** **1: 29.41%**	--
12	Model 1 + Lymph Node Involvement	0: HR=2.69 (1.21-5.97) 1: HR=0.95 (0.37-2.45) 2: HR=1.00 (REF) p=0.0030	10	n=341 d=59	**0: 57.23%** **1: 30.15%**	0: 0.74% 1: 1.04%
Subset--Restricted to participants with Tamoxifen Use, Smoking Status, & Physical Activity variables (24-month follow-up)						
Crude	Physical Component Summary Score (PCS)	0: HR=5.19 (2.51-10.74) 1: HR=1.42 (0.60-3.37) 2: HR=1.00 (REF) p=<0.0001	21	n=330 d=59	--	--
1	Age, Marital Status, & Tumor Stage	0: HR=2.40 (1.12-5.16) 1: HR=0.94 (0.39-2.27) 2: HR=1.00 (REF) p=0.0054	21	n=330 d=59	**0: 53.76%** **1: 33.80%**	--

Model	Variable(s) in model	Physical Component Summary Score (PCS) HR (95% CI)	Difference in 'N'	Total in model (n) and total dead (d)	% change from Crude	% change from model 1
13	Model 1 + Tamoxifen Use	0: HR=2.51 (1.18-5.37) 1: HR=0.93 (0.38-2.24) 2: HR=1.00 (REF) p=0.0027	21	n=330 d=59	**0: 51.64%** **1: 34.51%**	0: 4.58% 1: 1.06%
14	Model 1 + Smoking Status	0: HR=2.38 (1.11-5.09) 1: HR=0.93 (0.38-2.25) 2: HR=1.00 (REF) p=0.0057	21	n=330 d=59	**0: 54.14%** **1: 34.51%**	0: 0.83% 1: 1.06%
15	Model 1 + Physical Activity	0: HR=2.45 (1.13-5.28) 1: HR=0.94 (0.39-2.27) 2: HR=1.00 (REF) p=0.0049	21	n=330 d=59	**0: 52.79%** **1: 33.80%**	0: 2.08% 1: 0.00%
Subset--Restricted to participants with BMI variable						
Crude	Physical Component Summary Score (PCS)	0: HR=5.09 (2.36-10.99) 1: HR=1.41 (0.57-3.51) 2: HR=1.00 (REF) p=<0.0001	27	n=324 d=54	--	--

Model	Variable(s) in model	Physical Component Summary Score (PCS) HR (95% CI)	Difference in 'N'	Total in model (n) and total dead (d)	% change from Crude	% change from model 1
1	Age, Marital Status, & Tumor Stage	0: HR=2.41 (1.07-5.41) 1: HR=1.00 (0.39-2.52) 2: HR=1.00 (REF) p=0.0129	27	n=324 d=54	**0: 52.65%** **1: 29.08%**	--
16	Model 1 + BMI	0: HR=2.54 (1.11-5.83) 1: HR=1.07 (0.42-2.72) 2: HR=1.00 (REF) p=0.0147	27	n=324 d=54	**0: 50.10%** **1: 24.11%**	0: 5.12% 1: 7.00%
Subset--Restricted to participants with Tumor Subtype variable						
Crude	Physical Component Summary Score (PCS)	0: HR=4.43 (2.13-9.20) 1: HR=1.27 (0.53-3.07) 2: HR=1.00 (REF) p=<0.0001	51	n=300 d=56	--	--
1	Age, Marital Status, & Tumor Stage	0: HR=2.09 (0.97-4.52) 1: HR=0.86 (0.35-2.13) 2: HR=1.00 (REF) p=0.0172	51	n=300 d=56	**0: 52.82%** **1: 32.28%**	--

Model	Variable(s) in model	Physical Component Summary Score (PCS) HR (95% CI)	Difference in 'N'	Total in model (n) and total dead (d)	% change from Crude	% change from model 1
17	Model 1 + Tumor Subtype	0: HR=2.17 (1.01-4.71) 1: HR=0.88 (0.36-2.16) 2: HR=1.00 (REF) p=0.0132	51	n=300 d=56	**0: 51.02%** **1: 30.71%**	0: 3.83% 1: 2.33%
*Model 1 is considered the 'base' for adjustment when PCS is the predictor.						

Appendix L. Multivariable Modeling with Physical Component Summary Score as the Predictor and Non-Cancer Mortality as the Outcome (*N* = 351)

Model	Variable(s) in model	Physical Component Summary Score (PCS) HR (95% CI)	Difference in 'N'	Total in model (n) and total dead (d)	% change from Crude	% change from model 1	% change from previous model
Crude	Physical Component Summary Score (PCS)	0: HR=5.63 (2.74-11.55) 1: HR=1.41 (0.59-3.35) 2: HR=1.00 (REF) p=<0.0001	0	n=351 d=64	--	--	--
1	Age, Marital Status, & Tumor Stage	0: HR=2.53 (1.19-5.40) 1: HR=0.91 (0.38-2.19) 2: HR=1.00 (REF) p=0.0016	0	n=351 d=64	**0: 55.06%** **1: 35.46%**	--	--
2	Model 1 + Race/Ethnicity	0: HR=2.53 (1.18-5.39) 1: HR=0.90 (0.37-2.18) 2: HR=1.00 (REF) p=0.0016	0	n=351 d=64	**0: 55.06%** **1: 36.17%**	0: 0.00% 1: 1.10%	--
3	Model 1 + Race/Ethnicity + Treatment Type	0: HR=2.50 (1.17-5.32) 1: HR=0.86 (0.35-2.09) 2: HR=1.00 (REF) p=0.0013	0	n=351 d=64	**0: 55.60%** **1: 39.01%**	0: 1.19% 1: 5.49%	0: 1.19% 1: 4.44%
4	Model 1 + Race/Ethnicity + Treatment Type + Current Lymphedema	0: HR=2.60 (1.21-5.60) 1: HR=0.88 (0.36-2.15) 2: HR=1.00 (REF) p=0.0010	0	n=351 d=64	**0: 53.82%** **1: 37.59%**	0: 2.77% 1: 3.30%	0: 4.00% 1: 2.33%

Model	Variable(s) in model	Physical Component Summary Score (PCS) HR (95% CI)	Difference in 'N'	Total in model (n) and total dead (d)	% change from Crude	% change from model 1	% change from previous model
5	Model 1 + Race/Ethnicity + Treatment Type + Current Lymphedema + Optimism	0: HR=2.49 (1.16-5.38) 1: HR=0.86 (0.35-2.10) 2: HR=1.00 (REF) p=0.0015	0	n=351 d=64	**0: 55.77%** **1: 39.01%**	0: 1.58% 1: 5.49%	0: 4.23% 1: 2.27%
6	Model 1 + Race/Ethnicity + Treatment Type + Current Lymphedema + Optimism + Number of Types of Confidants (Confide)	0: HR=2.67 (1.23-5.77) 1: HR=0.94 (0.38-2.31) 2: HR=1.00 (REF) p=0.0014	0	n=351 d=64	**0: 52.58%** **1: 33.33%**	0: 5.53% 1: 3.30%	0: 7.23% 1: 9.30%
7	Model 1 + Race/Ethnicity + Treatment Type + Current Lymphedema + Optimism + Confide + Fear of Recurrence	0: HR=2.65 (1.22-5.74) 1: HR=0.95 (0.38-2.33) 2: HR=1.00 (REF) p=0.0015	0	n=351 d=64	**0: 52.93%** **1: 32.62%**	0: 4.74% 1: 4.40%	0: 0.75% 1: 1.06%
Subset--Restricted to participants with Education variable							
Crude	Physical Component Summary Score (PCS)	0: HR=5.51 (2.68-11.33) 1: HR=1.41 (0.59-3.35) 2: HR=1.00 (REF) p=<0.0001	1	n=350 d=63	--	--	--
1	Age, Marital Status, & Tumor Stage	0: HR=2.48 (1.16-5.29) 1: HR=0.90 (0.37-2.17) 2: HR=1.00 (REF) p=0.0022	1	n=350 d=63	**0: 54.99%** **1: 36.17%**	--	--

Model	Variable(s) in model	Physical Component Summary Score (PCS) HR (95% CI)	Difference in 'N'	Total in model (n) and total dead (d)	% change from Crude	% change from model 1	% change from previous model
8	Model 1 + Education	0: HR=2.59 (1.21-5.54) 1: HR=0.90 (0.37-2.17) 2: HR=1.00 (REF) p=0.0016	1	n=350 d=63	**0: 52.99%** **1: 36.17%**	0: 4.44% 1: 0.00%	--
9	Model 1 + Education + Race/Ethnicity	0: HR=2.57 (1.20-5.52) 1: HR=0.90 (0.37-2.15) 2: HR=1.00 (REF) p=0.0016	1	n=350 d=63	**0: 53.36%** **1: 36.17%**	0: 3.63% 1: 0.00%	0: 0.77% 1: 0.00%
10	Model 1 + Education + Race/Ethnicity + Treatment Type	0: HR=2.51 (1.17-5.37) 1: HR=0.85 (0.35-2.07) 2: HR=1.00 (REF) p=0.0014	1	n=350 d=63	**0: 54.45%** **1: 39.72%**	0: 1.21% 1: 5.56%	0: 2.33% 1: 5.56%
11	Model 1 + Education + Race/Ethnicity + Treatment Type + Current Lymphedema	0: HR=2.71 (1.25-5.84) 1: HR=0.88 (0.36-2.15) 2: HR=1.00 (REF) p=0.0008	1	n=350 d=63	**0: 50.82%** **1: 37.59%**	0: 9.27% 1: 2.22%	0: 7.97% 1: 3.53%
12	Model 1 + Education + Race/Ethnicity + Treatment Type + Current Lymphedema + Optimism	0: HR=2.61 (1.20-5.65) 1: HR=0.87 (0.36-2.11) 2: HR=1.00 (REF) p=0.0012	1	n=350 d=63	**0: 52.63%** **1: 38.30%**	0: 5.24% 1: 3.33%	0: 3.69% 1: 1.14%

Model	Variable(s) in model	Physical Component Summary Score (PCS) HR (95% CI)	Difference in 'N'	Total in model (n) and total dead (d)	% change from Crude	% change from model 1	% change from previous model
13	Model 1 + Education + Race/Ethnicity + Treatment Type + Current Lymphedema + Optimism + Confide	0: HR=2.71 (1.25-5.89) 1: HR=0.93 (0.38-2.28) 2: HR=1.00 (REF) p=0.0013	1	n=350 d=63	**0: 50.82%** **1: 34.04%**	0: 9.27% 1: 3.33%	0: 3.83% 1: 6.90%
14	Model 1 + Education + Race/Ethnicity + Treatment Type + Current Lymphedema + Optimism + Confide + Fear of Recurrence	0: HR=2.69 (1.24-5.84) 1: HR=0.93 (0.38-2.30) 2: HR=1.00 (REF) p=0.0014	1	n=350 d=63	**0: 51.18%** **1: 34.04%**	0: 8.47% 1: 3.33%	0: 0.74% 1: 0.00%
Subset--Restricted to participants with Tumor Size variable							
Crude	Physical Component Summary Score (PCS)	0: HR=5.43 (2.64-11.14) 1: HR=1.39 (0.59-3.30) 2: HR=1.00 (REF) p=<0.0001	10	n=341 d=64	--	--	--
1	Age, Marital Status, & Tumor Stage	0: HR=2.53 (1.19-5.39) 1: HR=0.92 (0.38-2.22) 2: HR=1.00 (REF) p=0.0018	10	n=341 d=64	**0: 53.41%** **1: 33.81%**	--	--
15	Model 1 + Tumor Size	0: HR=2.53 (1.19-5.39) 1: HR=0.91 (0.38-2.21) 2: HR=1.00 (REF) p=0.0018	10	n=341 d=64	**0: 53.41%** **1: 34.53%**	0: 0.00% 1: 1.09%	--

Model	Variable(s) in model	Physical Component Summary Score (PCS) HR (95% CI)	Difference in 'N'	Total in model (n) and total dead (d)	% change from Crude	% change from model 1	% change from previous model
16	Model 1 + Tumor Size + Race/Ethnicity	0: HR=2.52 (1.19-5.38) 1: HR=0.91 (0.38-2.20) 2: HR=1.00 (REF) p=0.0018	10	n=341 d=64	**0: 53.59%** **1: 34.53%**	0: 0.40% 1: 1.09%	0: 0.40% 1: 0.00%
17	Model 1 + Tumor Size + Race/Ethnicity + Treatment Type	0: HR=2.50 (1.17-5.32) 1: HR=0.87 (0.36-2.11) 2: HR=1.00 (REF) p=0.0013	10	n=341 d=64	**0: 53.96%** **1: 37.41%**	0: 1.19% 1: 5.43%	0: 0.79% 1: 4.40%
18	Model 1 + Tumor Size + Race/Ethnicity + Treatment Type + Current Lymphedema	0: HR=2.61 (1.22-5.61) 1: HR=0.89 (0.36-2.17) 2: HR=1.00 (REF) p=0.0011	10	n=341 d=64	**0: 51.93%** **1: 35.97%**	0: 3.16% 1: 3.26%	0: 4.40% 1: 2.30%
19	Model 1 + Tumor Size + Race/Ethnicity + Treatment Type + Current Lymphedema + Optimism	0: HR=2.50 (1.16-5.39) 1: HR=0.86 (0.35-2.11) 2: HR=1.00 (REF) p=0.0016	10	n=341 d=64	**0: 53.96%** **1: 38.13%**	0: 1.19% 1: 6.52%	0: 4.21% 1: 3.37%
20	Model 1 + Tumor Size + Race/Ethnicity + Treatment Type + Current Lymphedema + Optimism + Confide	0: HR=2.67 (1.23-5.78) 1: HR=0.95 (0.39-2.34) 2: HR=1.00 (REF) p=0.0016	10	n=341 d=64	**0: 50.83%** **1: 31.65%**	0: 5.53% 1: 3.26%	0: 6.80% **1: 10.47%**

Model	Variable(s) in model	Physical Component Summary Score (PCS) HR (95% CI)	Difference in 'N'	Total in model (n) and total dead (d)	% change from Crude	% change from model 1	% change from previous model
21	Model 1 + Tumor Size + Race/Ethnicity + Treatment Type + Current Lymphedema + Optimism + Confide + Fear of Recurrence	0: HR=2.66 (1.23-5.76) 1: HR=0.96 (0.39-2.36) 2: HR=1.00 (REF) p=0.0016	10	n=341 d=64	**0: 51.01%** **1: 30.94%**	0: 5.14% 1: 4.35%	0: 0.37% 1: 1.05%
Subset--Restricted to participants with Education and Tumor Size variables (24-month follow-up)							
Crude	Physical Component Summary Score (PCS)	0: HR=5.31 (2.59-10.92) 1: HR=1.39 (0.59-3.30) 2: HR=1.00 (REF) p=<0.0001	11	n=340 d=63	--	--	--
1	Age, Marital Status, & Tumor Stage	0: HR=2.48 (1.16-5.28) 1: HR=0.91 (0.38-2.20) 2: HR=1.00 (REF) p=0.0024	11	n=340 d=63	**0: 53.30%** **1: 34.53%**	--	--
22	Model 1 + Education + Tumor Size	0: HR=2.57 (1.20-5.50) 1: HR=0.91 (0.69-2.49) 2: HR=1.00 (REF) p=0.0018	11	n=340 d=63	**0: 51.60%** **1: 34.53%**	0: 3.63% 1: 0.00%	--
23	Model 1 Education + Tumor Size + Race/Ethnicity	0: HR=2.56 (1.20-5.48) 1: HR=0.90 (0.37-2.18) 2: HR=1.00 (REF) p=0.0018	11	n=340 d=63	**0: 51.79%** **1: 35.25%**	0: 3.23% 1: 1.10%	0: 0.39% 1: 1.10%

Model	Variable(s) in model	Physical Component Summary Score (PCS) HR (95% CI)	Difference in 'N'	Total in model (n) and total dead (d)	% change from Crude	% change from model 1	% change from previous model
24	Model 1 + Education + Tumor Size + Race/Ethnicity + Treatment Type	0: HR=2.49 (1.18-5.33) 1: HR=0.86 (0.36-2.10) 2: HR=1.00 (REF) p=0.0016	11	n=340 d=63	**0: 53.11%** **1: 38.13%**	0: 0.40% 1: 5.49%	0: 2.73% 1: 4.44%
25	Model 1 + Education + Tumor Size + Race/Ethnicity + Treatment Type + Current Lymphedema	0: HR=2.70 (1.25-5.83) 1: HR=0.89 (0.37-2.18) 2: HR=1.00 (REF) p=0.0009	11	n=340 d=63	**0: 49.15%** **1: 35.97%**	0: 8.87% 1: 2.20%	0: 8.43% 1: 3.49%
26	Model 1 + Education + Tumor Size + Race/Ethnicity + Treatment Type + Current Lymphedema + Optimism	0: HR=2.60 (1.20-5.64) 1: HR=0.88 (0.36-2.14) 2: HR=1.00 (REF) p=0.0014	11	n=340 d=63	**0: 51.04%** **1: 36.69%**	0: 4.84% 1: 3.30%	0: 3.70% 1: 1.12%
27	Model 1 + Education + Tumor Size + Race/Ethnicity + Treatment Type + Current Lymphedema + Optimism + Confide	0: HR=2.72 (1.25-5.91) 1: HR=0.95 (0.39-2.33) 2: HR=1.00 (REF) p=0.0015	11	n=340 d=63	**0: 48.78%** **1: 31.65%**	0: 9.68% 1: 4.40%	0: 4.62% 1: 7.95%
28	Model 1 + Education + Tumor Size + Race/Ethnicity + Treatment Type + Current Lymphedema + Optimism + Confide + Fear of Recurrence	0: HR=2.69 (1.24-5.85) 1: HR=0.95 (0.38-2.35) 2: HR=1.00 (REF) p=0.0016	11	n=340 d=63	**0: 49.34%** **1: 31.65%**	0: 8.47% 1: 4.40%	0: 1.10% 1: 0.00%
Subset--Restricted to participants with Tamoxifen Use & Physical Activity variable (24-month follow-up)							

Model	Variable(s) in model	Physical Component Summary Score (PCS) HR (95% CI)	Difference in 'N'	Total in model (n) and total dead (d)	% change from Crude	% change from model 1	% change from previous model
Crude	Physical Component Summary Score (PCS)	0: HR=5.19 (2.51-10.74) 1: HR=1.42 (0.60-3.37) 2: HR=1.00 (REF) p=<0.0001	21	n=330 d=59	--	--	--
1	Age, Marital Status, & Tumor Stage	0: HR=2.40 (1.12-5.16) 1: HR=0.94 (0.39-2.27) 2: HR=1.00 (REF) p=0.0054	21	n=330 d=59	**0: 53.76%** **1: 33.80%**	--	--
29	Model 1 + Tamoxifen Use + Physical Activity	0: HR=2.56 (1.19-5.48) 1: HR=0.93 (0.39-2.24) 2: HR=1.00 (REF) p=0.0025	21	n=330 d=59	**0: 50.67%** **1: 34.51%**	0: 6.67% 1: 1.06%	--
30	Model 1 + Tamoxifen Use + Physical Activity + Race/Ethnicity	0: HR=2.55 (1.19-5.47) 1: HR=0.92 (0.38-2.23) 2: HR=1.00 (REF) p=0.0025	21	n=330 d=59	**0: 50.87%** **1: 35.21%**	0: 6.25% 1: 2.13%	0: 0.39% 1: 1.08%
31	Model 1 + Tamoxifen Use + Physical Activity + Race/Ethnicity + Treatment Type	0: HR=2.47 (1.15-5.30) 1: HR=0.89 (0.37-2.16) 2: HR=1.00 (REF) p=0.0029	21	n=330 d=59	**0: 52.41%** **1: 37.32%**	0: 2.92% 1: 5.32%	0: 3.14% 1: 3.26%

Model	Variable(s) in model	Physical Component Summary Score (PCS) HR (95% CI)	Difference in 'N'	Total in model (n) and total dead (d)	% change from Crude	% change from model 1	% change from previous model
32	Model 1 + Tamoxifen Use + Physical Activity + Race/Ethnicity + Treatment Type + Current Lymphedema	0: HR=2.44 (1.12-5.31) 1: HR=0.90 (0.37-2.19) 2: HR=1.00 (REF) p=0.0050	21	n=330 d=59	**0: 52.99%** **1: 36.62%**	0: 1.67% 1: 4.26%	0: 1.21% 1: 1.12%
33	Model 1 + Tamoxifen Use + Physical Activity + Race/Ethnicity + Treatment Type + Current Lymphedema + Optimism	0: HR=2.45 (1.14-5.29) 1: HR=0.88 (0.36-2.15) 2: HR=1.00 (REF) p=0.0031	21	n=330 d=59	**0: 52.79%** **1: 38.03%**	0: 2.08% 1: 6.38%	0: 0.41% 1: 2.22%
34	Model 1 + Tamoxifen Use + Physical Activity + Race/Ethnicity + Treatment Type + Current Lymphedema + Optimism + Confide	0: HR=2.60 (1.19-5.68) 1: HR=0.94 (0.38-2.33) 2: HR=1.00 (REF) p=0.0027	21	n=330 d=59	**0: 49.90%** **1: 33.80%**	0: 8.33% 1: 0.00%	0: 6.12% 1: 6.82%
35	Model 1 + Tamoxifen Use + Physical Activity + Race/Ethnicity + Treatment Type + Current Lymphedema + Optimism + Confide + Fear of Recurrence	0: HR=2.60 (1.19-5.69) 1: HR=0.96 (0.39-2.38) 2: HR=1.00 (REF) p=0.0029	21	n=330 d=59	**0: 49.90%** **1: 32.39%**	0: 8.33% 1: 2.13%	0: 0.00% 1: 2.13%
Subset--Restricted to participants with Education, Tumor Size, Tamoxifen Use, and Physical Activity variables							
Crude	Physical Component Summary Score (PCS)	0: HR=4.88 (2.35-10.12) 1: HR=1.40 (0.59-3.33) 2: HR=1.00 (REF) p=<0.0001	32	n=319 d=58	--	--	--

Model	Variable(s) in model	Physical Component Summary Score (PCS) HR (95% CI)	Difference in 'N'	Total in model (n) and total dead (d)	% change from Crude	% change from model 1	% change from previous model
1	Age, Marital Status, & Tumor Stage	0: HR=2.35 (1.09-5.05) 1: HR=0.95 (0.39-2.29) 2: HR=1.00 (REF) p=0.0078	32	n=319 d=58	**0: 51.84%** **1: 32.14%**	--	--
36	Model 1 + Education + Tumor Size + Tamoxifen Use + Physical Activity	0: HR=2.65 (1.22-5.72) 1: HR=0.94 (0.39-2.27) 2: HR=1.00 (REF) p=0.0024	32	n=319 d=58	**0: 45.70%** **1: 32.86%**	**0: 12.77%** 1: 1.05%	--
37	Model 1 + Education + Tumor Size + Tamoxifen Use + Physical Activity + Race/Ethnicity	0: HR=2.64 (1.22-5.71) 1: HR=0.94 (0.39-2.26) 2: HR=1.00 (REF) p=0.0025	32	n=319 d=58	**0: 45.90%** **1: 32.86%**	**0: 12.34%** 1: 1.05%	0: 0.38% 1: 0.00%
38	Model 1 + Education + Tumor Size + Tamoxifen Use + Physical Activity + Race/Ethnicity + Treatment Type	0: HR=2.52 (1.17-5.44) 1: HR=0.89 (0.37-2.17) 2: HR=1.00 (REF) p=0.0029	32	n=319 d=58	**0: 48.36%** **1: 36.43%**	0: 7.23% 1: 6.32%	0: 4.55% 1: 5.32%
39	Model 1 + Education + Tumor Size + Tamoxifen Use + Physical Activity + Race/Ethnicity + Treatment Type + Current Lymphedema	0: HR=2.61 (1.20-5.67) 1: HR=0.91 (0.37-2.21) 2: HR=1.00 (REF) p=0.0024	32	n=319 d=58	**0: 46.52%** **1: 35.00%**	**0: 11.06%** 1: 4.21%	0: 3.57% 1: 2.25%

Model	Variable(s) in model	Physical Component Summary Score (PCS) HR (95% CI)	Difference in 'N'	Total in model (n) and total dead (d)	% change from Crude	% change from model 1	% change from previous model
40	Model 1 + Education + Tumor Size + Tamoxifen Use + Physical Activity + Race/Ethnicity + Treatment Type + Current Lymphedema + Optimism	0: HR=2.58 (1.18-5.60) 1: HR=0.89 (0.36-2.19) 2: HR=1.00 (REF) p=0.0026	32	n=319 d=58	**0: 47.13%** **1: 36.43%**	0: 9.79% 1: 6.32%	0: 1.15% 1: 2.20%
41	Model 1 + Education + Tumor Size + Tamoxifen Use + Physical Activity + Race/Ethnicity + Treatment Type + Current Lymphedema + Optimism + Confide	0: HR=2.67 (1.21-5.87) 1: HR=0.94 (0.38-2.34) 2: HR=1.00 (REF) p=0.0024	32	n=319 d=58	**0: 45.29%** **1: 32.86%**	**0: 13.62%** 1: 1.05%	0: 3.49% 1: 5.62%
42	Model 1 + Education + Tumor Size + Tamoxifen Use + Physical Activity + Race/Ethnicity + Treatment Type + Current Lymphedema + Optimism + Confide + Fear of Recurrence	0: HR=2.66 (1.21-5.85) 1: HR=0.95 (0.38-2.38) 2: HR=1.00 (REF) p=0.0027	32	n=319 d=58	**0: 45.49%** **1: 32.14%**	**0: 13.19%** 1: 0.00%	0: 0.37% 1: 1.06%
Subset--Restricted to participants with BMI variable							
Crude	Physical Component Summary Score (PCS)	0: HR=5.09 (2.36-10.99) 1: HR=1.41 (0.57-3.51) 2: HR=1.00 (REF) p=<0.0001	27	n=324 d=54	--	--	--
1	Age, Marital Status, & Tumor Stage	0: HR=2.41 (1.07-5.41) 1: HR=1.00 (0.39-2.52) 2: HR=1.00 (REF) p=0.0129	27	n=324 d=54	**0: 52.65%** **1: 29.08%**	--	--

Model	Variable(s) in model	Physical Component Summary Score (PCS) HR (95% CI)	Difference in 'N'	Total in model (n) and total dead (d)	% change from Crude	% change from model 1	% change from previous model
43	Model 1 + BMI	0: HR=2.54 (1.11-5.83) 1: HR=1.07 (0.42-2.72) 2: HR=1.00 (REF) p=0.0147	27	n=324 d=54	**0: 50.10%** **1: 24.11%**	0: 5.39% 1: 7.00%	--
44	Model 1 + BMI + Race/Ethnicity	0: HR=2.54 (1.11-5.82) 1: HR=1.07 (0.42-2.71) 2: HR=1.00 (REF) p=0.0150	27	n=324 d=54	**0: 50.10%** **1: 24.11%**	0: 5.39% 1: 7.00%	0: 0.00% 1: 0.00%
45	Model 1 + BMI + Race/Ethnicity + Treatment Type	0: HR=2.42 (1.05-5.57) 1: HR=1.03 (0.41-2.63) 2: HR=1.00 (REF) p=0.0184	27	n=324 d=54	**0: 52.46%** **1: 26.95%**	0: 0.41% 1: 3.00%	0: 4.72% 1: 3.74%
46	Model 1 + BMI + Race/Ethnicity + Treatment Type + Current Lymphedema	0: HR=2.50 (1.08-5.78) 1: HR=1.06 (0.41-2.70) 2: HR=1.00 (REF) p=0.0160	27	n=324 d=54	**0: 50.88%** **1: 24.82%**	0: 3.73% 1: 6.00%	0: 3.31% 1: 2.91%
47	Model 1 + BMI + Race/Ethnicity + Treatment Type + Current Lymphedema + Optimism	0: HR=2.37 (1.03-5.50) 1: HR=0.99 (0.39-2.56) 2: HR=1.00 (REF) p=0.0187	27	n=324 d=54	**0: 53.44%** **1: 29.79%**	0: 1.66% 1: 1.00%	0: 5.20% 1: 6.60%

Model	Variable(s) in model	Physical Component Summary Score (PCS) HR (95% CI)	Difference in 'N'	Total in model (n) and total dead (d)	% change from Crude	% change from model 1	% change from previous model
48	Model 1 + BMI + Race/Ethnicity + Treatment Type + Current Lymphedema + Optimism + Confide	0: HR=2.59 (1.11-6.02) 1: HR=1.08 (0.42-2.78) 2: HR=1.00 (REF) p=0.0150	27	n=324 d=54	**0: 49.12%** **1: 23.40%**	0: 7.47% 1: 8.00%	0: 9.28% 1: 9.09%
49	Model 1 + BMI + Race/Ethnicity + Treatment Type + Current Lymphedema + Optimism + Confide + Fear of Recurrence	0: HR=2.54 (1.09-5.89) 1: HR=1.08 (0.42-2.78) 2: HR=1.00 (REF) p=0.0174	27	n=324 d=54	**0: 50.10%** **1: 23.40%**	0: 5.39% 1: 8.00%	0: 1.93% 1: 0.00%
Subset--Restricted to participants with Education, Tumor Size, Tamoxifen Use, Physical Activity, & BMI variables							
Crude	Physical Component Summary Score (PCS)	0: HR=4.42 (2.03-9.65) 1: HR=1.40 (0.56-3.47) 2: HR=1.00 (REF) p=<0.0001	56	n=295 d=49	--	--	--
1	Age, Marital Status, & Tumor Stage	0: HR=2.32 (1.02-5.25) 1: HR=1.01 (0.40-2.56) 2: HR=1.00 (REF) p=0.0231	56	n=295 d=49	**0: 47.51%** **1: 27.86%**	--	--
50	Model 1 + Education + Tumor Size + Tamoxifen Use + Physical Activity + BMI	0: HR=2.88 (1.23-6.72) 1: HR=1.06 (0.42-2.68) 2: HR=1.00 (REF) p=0.0068	56	n=295 d=49	**0: 34.84%** **1: 24.29%**	**0: 24.14%** 1: 4.95%	--

Model	Variable(s) in model	Physical Component Summary Score (PCS) HR (95% CI)	Difference in 'N'	Total in model (n) and total dead (d)	% change from Crude	% change from model 1	% change from previous model
51	Model 1 + Education + Tumor Size + Tamoxifen Use + Physical Activity + BMI + Race/Ethnicity	0: HR=2.87 (1.23-6.70) 1: HR=1.05 (0.42-2.67) 2: HR=1.00 (REF) p=0.0069	56	n=295 d=49	**0: 35.07%** **1: 25.00%**	**0: 23.71%** 1: 3.96%	0: 0.35% 1: 0.94%
52	Model 1 + Education + Tumor Size + Tamoxifen Use + Physical Activity + BMI + Race/Ethnicity + Treatment Type	0: HR=2.63 (1.13-6.14) 1: HR=1.02 (0.40-2.61) 2: HR=1.00 (REF) p=0.0139	56	n=295 d=49	**0: 40.50%** **1: 27.14%**	**0: 13.36%** 1: 0.99%	0: 8.36% 1: 2.86%
53	Model 1 + Education + Tumor Size + Tamoxifen Use + Physical Activity + BMI + Race/Ethnicity + Treatment Type + Current Lymphedema	0: HR=2.60 (1.10-6.11) 1: HR=1.03 (0.40-2.63) 2: HR=1.00 (REF) p=0.0178	56	n=295 d=49	**0: 41.18%** **1: 26.43%**	**0: 12.07%** 1: 1.98%	0: 1.14% 1: 0.98%
54	Model 1 + Education + Tumor Size + Tamoxifen Use + Physical Activity + BMI + Race/Ethnicity + Treatment Type + Current Lymphedema + Optimism	0: HR=2.55 (1.08-6.02) 1: HR=0.99 (0.38-2.57) 2: HR=1.00 (REF) p=0.0169	56	n=295 d=49	**0: 42.31%** **1: 29.29%**	0: 9.91% 1: 1.98%	0: 1.92% 1: 3.88%
55	Model 1 + Education + Tumor Size + Tamoxifen Use + Physical Activity + BMI + Race/Ethnicity + Treatment Type + Current Lymphedema + Optimism + Confide	0: HR=2.65 (1.11-6.29) 1: HR=1.04 (0.40-2.74) 2: HR=1.00 (REF) p=0.0158	56	n=295 d=49	**0: 40.06%** **1: 25.71%**	**0: 14.22%** 1: 2.97%	0: 3.92% 1: 5.05%

Model	Variable(s) in model	Physical Component Summary Score (PCS) HR (95% CI)	Difference in 'N'	Total in model (n) and total dead (d)	% change from Crude	% change from model 1	% change from previous model
56	Model 1 + Education + Tumor Size + Tamoxifen Use + Physical Activity + BMI + Race/Ethnicity + Treatment Type + Current Lymphedema + Optimism + Confide + Fear of Recurrence	0: HR=2.56 (1.07-6.11) 1: HR=1.05 (0.40-2.76) 2: HR=1.00 (REF) p=0.0226	56	n=295 d=49	**0: 42.08%** **1: 25.00%**	**0: 10.34%** 1: 3.96%	0: 3.40% 1: 0.96%

Appendix M. Mental Component Summary Score Univariate HR Analysis and Percent Change for Non-Cancer Mortality when Assessing for Potential Confounders (*N* = 351)

Model	Variable(s) in model	Categories	Total in categories (n)	Total in model (n); dead (d)	Missing	Univariate-Cox HR (95% CI)	p-values*	MCS HR (95% CI) and p-values	% change from crude model
Crude	Mental Component Summary Score (MCS)	0: ≤ 45.12 1: > 45.12 & ≤ 54.40 2: > 54.40 (REF)	0: 117 1: 117 2: 117	n=351 d=64	0	0: HR=1.45 (0.78-2.72) 1: HR=1.42 (0.76-2.64)	p=0.4424	0: HR=1.45 (0.78-2.72) p(MCS)=0.2439 1: HR=1.42 (0.76-2.64) p(MCS)=0.2705	--
1	Age	Continuous	--	n=351 d=64	0	HR=1.11 (1.08-1.14)	**p=<0.0001**	0: HR=1.83 (0.98-3.44) p(MCS)=0.0596 1: HR=1.44 (0.77-2.69) p(MCS)=0.2576 p(Age)=<0.0001	**0: 26.21%** 1: 1.41%
2	Race/Ethnicity	0: Non-Hispanic White (REF) 1: Hispanic	0: 273 1: 78	n=351 d=64	0	0: HR=1.00 1: HR=0.53 (0.26-1.07)	**p=0.0774**	0: HR=1.52 (0.81-2.85) p(MCS)=0.1917 1: HR=1.46 (0.78-2.72) p(MCS)=0.2331 p(Ethnicity)=0.0774	0: 4.83% 1: 2.82%
3	Marital Status	0: Single 1: Married (REF)	0: 160 1: 191	n=351 d=64	0	0: HR=2.65 (1.57-4.48) 1: HR=1.00	**p=0.0003**	0: HR=1.44 (0.77-2.69) p(MCS)=0.2574 1: HR=1.48 (0.79-2.75) p(MCS)=0.2207 p(Marital)=0.0003	0: 0.69% 1: 4.23%

Model	Variable(s) in model	Categories	Total in categories (n)	Total in model (n); dead (d)	Missing	Univariate-Cox HR (95% CI)	p-values*	MCS HR (95% CI) and p-values	% change from crude model
4	Tumor Stage	0: Localized (I) 1: Regional (II-IIIa)	0: 276 1: 75	n=351 d=64	0	0: HR=1.00 1: HR=0.77 (0.40-1.48)	p=0.4351	0: HR=1.43 (0.76-2.68) p(MCS)=0.2630 1: HR=1.41 (0.76-2.63) p(MCS)=0.2781 p(Stage)=0.4351	0: 1.38% 1: 0.70%
5	Breast Cancer Treatment Type	0: Surgery only (REF) 1: Any chemotherapy 2: Surgery and radiation	0: 98 1: 109 2: 144	n=351 d=64	0	0: HR=1.00 1: HR=0.36 (0.18-0.72) 2: HR=0.66 (0.39-1.13)	**p=0.0154**	0: HR=1.51 (0.81-2.84) p(MCS)=0.1956 1: HR=1.45 (0.78-2.70) p(MCS)=0.2441 p(Treatment1)=0.0043 p(Treatment2)=0.1312	0: 4.14% 1: 2.11%
6	Comorbidities	0: Zero (REF) 1: One or more	0: 298 1: 53	n=351 d=64	0	0: HR=1.00 1: HR=1.86 (1.02-3.39)	**p=0.0442**	0: HR=1.34 (0.71-2.53) p(MCS)=0.3636 1: HR=1.40 (0.75-2.60) p(MCS)=0.2903 p(Comorbidities)=0.0442	0: 7.59% 1: 1.41%
7	Current Lymphedema	0: No (REF) 1: Yes	0: 307 1: 44	n=351 d=64	0	0: HR=1.00 1: HR=0.62 (0.26-1.44)	p=0.2624	0: HR=1.53 (0.81-2.87) p(MCS)=0.1902 1: HR=1.45 (0.78-2.69) p(MCS)=0.2465 p(Lymphedema)=0.2624	0: 5.52% 1: 2.11%

Model	Variable(s) in model	Categories	Total in categories (n)	Total in model (n); dead (d)	Missing	Univariate-Cox HR (95% CI)	p-values*	MCS HR (95% CI) and p-values	% change from crude model
8	Perceived Optimism	0: ≤ 10 1: > 10 (REF)	0: 83 1: 268	n=351 d=64	0	0: HR=2.08 (1.23-3.53) 1: HR=1.00	**p=0.0066**	0: HR=1.16 (0.60-2.23) p(MCS)=0.6636 1: HR=1.26 (0.67-2.36) p(MCS)=0.4759 p(Optimism)=0.0066	**0: 20.00%** **1: 11.27%**
9	Perceived Pessimism	0: ≤ 10 (REF) 1: > 10	0: 255 1: 96	n=351 d=64	0	0: HR=1.00 1: HR=1.80 (1.07-3.04)	**p=0.0264**	0: HR=1.25 (0.66-2.38) p(MCS)=0.5018 1: HR=1.32 (0.71-2.47) p(MCS)=0.3831 p(Pessimism)=0.0264	**0: 13.79%** 1: 7.04%
10	Current Fatigue	0: No (REF) 1: Yes	0: 136 1: 215	n=351 d=64	0	0: HR=1.00 1: HR=1.03 (0.58-1.82)	p=0.9171	0: HR=1.43 (0.72-2.85) p(MCS)=0.3081 1: HR=1.41 (0.75-2.65) p(MCS)=0.2870 p(Fatigue)=0.9171	0: 1.38% 1: 0.70%
11	Fear of Recurrence	0: No (REF) 1: Yes	0: 154 1: 197	n=351 d=64	0	0: HR=1.00 1: HR=0.45 (0.27-0.74)	**p=0.0019**	0: HR=1.72 (0.91-3.24) p(MCS)=0.0961 1: HR=1.60 (0.86-3.00) p(MCS)=0.1396 p(Fear)=0.0019	**0: 18.62%** **1: 12.68%**

Model	Variable(s) in model	Categories	Total in categories (n)	Total in model (n); dead (d)	Missing	Univariate-Cox HR (95% CI)	p-values*	MCS HR (95% CI) and p-values	% change from crude model
12	Number of Types of Confidants	0: < 3 1: 4-5 2: > 5 (REF)	0: 66 1: 172 2: 113	n=351 d=64	0	0: HR=2.86 (1.42-5.75) 1: HR=1.60 (0.84-3.06) 2: HR=1.00	**p=0.0105**	0: HR=1.44 (0.77-2.69) p(MCS)=0.2591 1: HR=1.44 (0.77-2.68) p(MCS)=0.2529 p(Confidant0)=0.0032 p(Confidant1)=0.1565	0: 0.69% 1: 1.41%
13	Bodily Pain	0: No Pain 1: Experienced Pain (REF)	0: 180 1: 171	n=351 d=64	0	0: HR=1.00 1: HR=1.51 (0.80-2.85)	**p=0.2006**	0: HR=1.37 (0.73-2.58) p(MCS)=0.3285 1: HR=1.39 (0.74-2.58) p(MCS)=0.3053 p(Pain)=0.2006	0: 5.52% 1: 2.11%
14	Perceived General Health	0: "Poor" & "Fair" 1: "Good", "Very Good", & "Excellent" (REF)	0: 54 1: 297	n=351 d=64	0	0: HR=2.84 (1.62-4.97) 1: HR=1.00	**p=0.0003**	0: HR=1.08 (0.56-2.09) p(MCS)=0.8160 1: HR=1.36 (0.73-2.53) p(MCS)=0.3391 p(Health)=0.0003	**0: 25.52%** 1: 4.23%
Crude	MCS (restricted to those with education)		0: 117 1: 116 2: 117	n=350 d=63		0: HR=1.45 (0.78-2.72) 1: HR=1.36 (0.73-2.55)	p=0.4697	0: HR=1.45 (0.78-2.72) p(MCS)=0.2438 1: HR=1.36 (0.73-2.55) p(MCS)=0.3346	--

Model	Variable(s) in model	Categories	Total in categories (n)	Total in model (n); dead (d)	Missing	Univariate-Cox HR (95% CI)	p-values*	MCS HR (95% CI) and p-values	% change from crude model
15	Education	0: High school or less 1: Some college 2: College graduate 3: Graduate school (REF)	0: 92 1: 114 2: 70 3: 74	n=350 d=63	1	0: HR=2.88 (1.22-6.85) 1: HR=2.24 (0.96-5.19) 2: HR=1.85 (0.73-4.70) 3: HR=1.00	**p=0.1075**	0: HR=1.46 (0.78-2.75) p(MCS)=0.2356 1: HR=1.44 (0.77-2.71) p(MCS)=0.2356 p(Education0)=0.0163 p(Education1)=0.0612 p(Education2)=0.1989	0: 0.69% 1: 5.88%
Crude	MCS (restricted to those with tumor size)		0: 113 1: 114 2: 114	n=341 d=64		0: HR=1.48 (0.79-2.77) 1: HR=1.43 (0.77-2.67)	p=0.4136	0: HR=1.48 (0.79-2.77) p(MCS)=0.2216 1: HR=1.43 (0.77-2.67) p(MCS)=0.2569	--
16	Tumor Size	0: < 3 cm (REF) 1: ≥ 3 cm	0: 304 1: 37	n=341 d=64	10	0: HR=1.00 1: HR=0.43 (0.14-1.38)	**p=0.1574**	0: HR=1.50 (0.80-2.80) p(MCS)=0.2095 1: HR=1.42 (0.76-2.64) p(MCS)=0.2702 p(Size)=0.1574	0: 1.35% 1: 0.70%
Crude	MCS (restricted to those with lymph node involvement)		0: 112 1: 114 2: 115	n=341 d=59		0: HR=1.26 (0.66-2.41) 1: HR=1.31 (0.70-2.47)	p=0.6737	0: HR=1.26 (0.66-2.41) p(MCS)=0.4803 1: HR=1.31 (0.70-2.47) p(MCS)=0.4008	--

Model	Variable(s) in model	Categories	Total in categories (n)	Total in model (n); dead (d)	Missing	Univariate-Cox HR (95% CI)	p-values*	MCS HR (95% CI) and p-values	% change from crude model
17	Lymph Node Involvement	0: None (REF) 1: ≥ 1 lymph node involved	0: 264 1: 77	n=341 d=59	10	0: HR=1.00 1: HR=0.81 (0.42-1.56)	p=0.5276	0: HR=1.25 (0.65-2.39) p(MCS)=0.4997 1: HR=1.31 (0.70-2.47) p(MCS)=0.4055 p(Lymph node)=0.5276	0: 0.79% 1: 0.00%
Crude	MCS (restricted to those with Tamoxifen use, smoking status, and physical activity)		0: 110 1: 109 2: 111	n=330 d=59		0: HR=1.52 (0.80-2.89) 1: HR=1.33 (0.70-2.56)	p=0.4430	0: HR=1.52 (0.80-2.89) p(MCS)=0.2060 1: HR=1.33 (0.70-2.56) p(MCS)=0.3870	--
18	Tamoxifen Use	0: No 1: Yes (REF)	0: 160 1: 170	n=330 d=59	21	0: HR=1.25 (0.75-2.09) 1: HR=1.00	p=0.3983	0: HR=1.49 (0.78-2.85) p(MCS)=0.2227 1: HR=1.31 (0.68-2.51) p(MCS)=0.4239 p(Tamoxifen)=0.3983	0: 1.49% 1: 1.50%
19	Smoking Status	0: Never (REF) 1: Former 2: Current	0: 145 1: 144 2: 41	n=330 d=59	21	0: HR=1.00 1: HR=1.00 (0.58-1.73) 2: HR=1.25 (0.56-2.78)	p=0.8476	0: HR=1.49 (0.78-2.85) p(MCS)=0.2289 1: HR=1.33 (0.69-2.55) p(MCS)=0.3925 p(Smoker1)=0.9984 p(Smoker2)=0.5901	0: 1.49% 1: 0.00%

Model	Variable(s) in model	Categories	Total in categories (n)	Total in model (n); dead (d)	Missing	Univariate-Cox HR (95% CI)	p-values*	MCS HR (95% CI) and p-values	% change from crude model
20	Physical Activity	0: None 1: Low 2: Moderate/Vigorous (REF)	0: 185 1: 59 2: 86	n=330 d=59	21	0: HR=2.24 (1.15-4.36) 1: HR=0.54 (0.17-1.71) 2: HR=1.00	**p=0.0033**	0: HR=1.70 (0.89-3.25) p(MCS)=0.1089 1: HR=1.54 (0.80-2.97) p(MCS)=0.1966 p(PA0)=0.0176 p(PA1)=0.2974	**0: 11.84%** **1: 15.79%**
Crude	MCS (restricted to those with BMI)		0: 110 1: 108 2: 106	n=324 d=54		0: HR=1.31 (0.67-2.58) 1: HR=1.29 (0.66-2.52)	p=0.6886	0: HR=1.31 (0.67-2.58) p(MCS)=0.1963 1: HR=1.29 (0.66-2.52) p(MCS)=0.4547	--
21	Body Mass Index (BMI)	0: <25 (REF) 1: 25-29 2: ≥30	0: 161 1: 99 2: 64	n=324 d=54	27	0: HR=1.00 1: HR=0.61 (0.31-1.24) 2: HR=1.53 (0.80-2.91)	**p=0.0755**	0: HR=1.31 (0.66-2.57) p(MCS)=0.4383 1: HR=1.38 (0.70-2.72) p(MCS)=0.3556 p(BMI1)=0.1727 p(BMI2)=0.1972	0: 0.00% 1: 6.98%
Crude	MCS (restricted to those tumor subtype)		0: 99 1: 99 2: 102	n=300 d=56		0: HR=1.16 (0.60-2.26) 1: HR=1.27 (0.67-2.40)	p=0.7681	0: HR=1.16 (0.60-2.26) p(MCS)=0.6573 1: HR=1.27 (0.67-2.40) p(MCS)=0.4695	--

Model	Variable(s) in model	Categories	Total in categories (n)	Total in model (n); dead (d)	Missing	Univariate-Cox HR (95% CI)	p-values*	MCS HR (95% CI) and p-values	% change from crude model
22	Tumor Subtype	0: ER+ (REF) 1: ER-	0: 251 1: 49	n=300 d=56	51	0: HR=1.00 1: HR=1.24 (0.64-2.41)	p=0.5186	0: HR=1.15 (0.59-2.24) p(MCS)=0.6747 1: HR=1.25 (0.66-2.37) p(MCS)=0.5025 p(Subtype)=0.5186	0: 0.86% 1: 1.57%

*Bolded p-values are <0.25.

Appendix N. Percent Change from Crude and Model 1 with Each Potential Confounder (MCS & Non-Cancer Mortality) (N = 351)

Model	Variable(s) in model	Mental Component Summary Score (MCS) (95% CI)	Difference in 'N'	Total in model (n) and total dead (d)	% change from Crude	% change from model 1
Dataset restricted to those with full HRQOL data and baseline covariates						
Crude	Mental Component Summary Score (MCS)	0: HR=1.45 (0.78-2.72) 1: HR=1.42 (0.76-2.64) 2: HR=1.00 (REF) p=0.4424	0	n=351 d=64	--	--
1	Age, Marital Status, & Tumor Stage	0: HR=1.73 (0.92-3.25) 1: HR=1.46 (0.78-2.72) 2: HR=1.00 (REF) p=0.2327	0	n=351 d=64	**0: 19.31%** 1: 2.82%	--
2	Model 1 + Race/Ethnicity	0: HR=1.73 (0.92-3.27) 1: HR=1.45 (0.78-2.72) 2: HR=1.00 (REF) p=0.2293	0	n=351 d=64	**0: 19.31%** 1: 2.11%	0: 0.00% 1: 0.68%
3	Model 1 + Treatment Type	0: HR=1.73 (0.92-3.26) 1: HR=1.40 (0.74-2.64) 2: HR=1.00 (REF) p=0.2395	0	n=351 d=64	**0: 19.31%** 1: 1.41%	0: 0.00% 1: 4.11%

Model	Variable(s) in model	Mental Component Summary Score (MCS) (95% CI)	Difference in 'N'	Total in model (n) and total dead (d)	% change from Crude	% change from model 1
4	Model 1 + Comorbidities	0: HR=1.64 (0.85-3.15) 1: HR=1.47 (0.78-2.74) 2: HR=1.00 (REF) p=0.3020	0	n=351 d=64	**0: 13.10%** 1: 3.52%	0: 5.20% 1: 0.68%
5	Model 1 + Current Lymphedema	0: HR=1.74 (0.92-3.30) 1: HR=1.46 (0.78-2.73) 2: HR=1.00 (REF) p=0.2310	0	n=351 d=64	**0: 20.00%** 1: 2.82%	0: 0.58% 1: 0.00%
6	Model 1 + Optimism	0: HR=1.60 (0.83-3.06) 1: HR=1.35 (0.71-2.56) 2: HR=1.00 (REF) p=0.3678	0	n=351 d=64	**0: 10.34%** 1: 4.93%	0: 7.51% 1: 7.53%
7	Model 1 + Pessimism	0: HR=1.52 (0.79-2.91) 1: HR=1.39 (0.74-2.61) 2: HR=1.00 (REF) p=0.4252	0	n=351 d=64	0: 4.83% 1: 2.11%	**0: 12.14%** 1: 4.79%
9	Model 1 + Current Fatigue	0: HR=1.58 (0.76-3.29) 1: HR=1.41 (0.74-2.67) 2: HR=1.00 (REF) p=0.4371	0	n=351 d=64	0: 8.97% 1: 0.70%	0: 8.67% 1: 3.42%

Model	Variable(s) in model	Mental Component Summary Score (MCS) (95% CI)	Difference in 'N'	Total in model (n) and total dead (d)	% change from Crude	% change from model 1
10	Model 1 + Fear of Recurrence	0: HR=1.83 (0.96-3.46) 1: HR=1.52 (0.81-2.84) 2: HR=1.00 (REF) p=0.1739	0	n=351 d=64	**0: 26.21%** 1: 7.04%	0: 5.78% 1: 4.11%
11	Model 1 + Number of Types of Confidants	0: HR=1.75 (0.93-3.31) 1: HR=1.53 (0.82-2.88) 2: HR=1.00 (REF) p=0.2085	0	n=351 d=64	**0: 20.69%** 1: 7.75%	0: 1.16% 1: 4.79%
12	Model 1 + Bodily Pain	0: HR=1.69 (0.89-3.21) 1: HR=1.44 (0.77-2.70) 2: HR=1.00 (REF) p=0.2679	0	n=351 d=64	**0: 16.55%** 1: 1.41%	0: 2.31% 1: 1.37%
13	Model 1 + Perceived General Health	0: HR=1.41 (0.72-2.74) 1: HR=1.49 (0.79-2.79) 2: HR=1.00 (REF) p=0.4240	0	n=351 d=64	0: 2.76% 1: 4.93%	**0: 18.50%** 1: 2.05%
Subset--Restricted to participants with Education variable						

Model	Variable(s) in model	Mental Component Summary Score (MCS) (95% CI)	Difference in 'N'	Total in model (n) and total dead (d)	% change from Crude	% change from model 1
Crude	Mental Component Summary Score (MCS)	0: HR=1.45 (0.78-2.72) 1: HR=1.36 (0.73-2.55) 2: HR=1.00 (REF) p=0.4751	1	n=350 d=63	--	--
1	Age, Marital Status, & Tumor Stage	0: HR=1.76 (0.94-3.30) 1: HR=1.39 (0.74-2.61) 2: HR=1.00 (REF) p=0.2145	1	n=350 d=63	**0: 21.38%** 1: 2.21%	--
14	Model 1 + Education	0: HR=1.72 (0.91-3.25) 1: HR=1.54 (0.81-2.94) 2: HR=1.00 (REF) p=0.2187	1	n=350 d=63	**0: 18.62%** **1: 13.24%**	0: 2.27% **1: 10.79%**
Subset--Restricted to participants with the Tumor Size variable						
Crude	Mental Component Summary Score (MCS)	0: HR=1.48 (0.79-2.77) 1: HR=1.43 (0.77-2.67) 2: HR=1.00 (REF) p=0.4136	10	n=341 d=64	--	--

Model	Variable(s) in model	Mental Component Summary Score (MCS) (95% CI)	Difference in 'N'	Total in model (n) and total dead (d)	% change from Crude	% change from model 1
1	Age, Marital Status, & Tumor Stage	0: HR=1.71 (0.91-3.22) 1: HR=1.45 (0.78-2.72) 2: HR=1.00 (REF) p=0.2438	10	n=341 d=64	**0: 15.54%** 1: 1.40%	--
15	Model 1 + Tumor Size	0: HR=1.71 (0.91-3.22) 1: HR=1.46 (0.78-2.74) 2: HR=1.00 (REF) p=0.2433	10	n=341 d=64	**0: 15.54%** 1: 2.10%	0: 0.00% 1: 0.69%
Subset--Restricted to participants with Lymph Node Involvement variable						
Crude	Mental Component Summary Score (MCS)	0: HR=1.26 (0.66-2.41) 1: HR=1.31 (0.70-2.47) 2: HR=1.00 (REF) p=0.6737	10	n=341 d=59	--	--
1	Age, Marital Status, & Tumor Stage	0: HR=1.55 (0.81-2.98) 1: HR=1.53 (0.81-2.91) 2: HR=1.00 (REF) p=0.3260	10	n=341 d=59	**0: 23.02%** **1: 16.79%**	--

Model	Variable(s) in model	Mental Component Summary Score (MCS) (95% CI)	Difference in 'N'	Total in model (n) and total dead (d)	% change from Crude	% change from model 1
16	Model 1 + Lymph Node Involvement	0: HR=1.53 (0.80-2.96) 1: HR=1.52 (0.80-2.89) 2: HR=1.00 (REF) p=0.3480	10	n=341 d=59	**0: 21.43%** **1: 16.03%**	0: 1.29% 1: 0.65%
Subset--Restricted to participants with Tamoxifen Use, Smoking Status, & Physical Activity variables (24-month follow-up)						
Crude	Mental Component Summary Score (MCS)	0: HR=1.52 (0.80-2.89) 1: HR=1.33 (0.70-2.56) 2: HR=1.00 (REF) p=0.4430	21	n=330 d=59	--	--
1	Age, Marital Status, & Tumor Stage	0: HR=1.75 (0.91-3.37) 1: HR=1.39 (0.72-2.68) 2: HR=1.00 (REF) p=0.2429	21	n=330 d=59	**0: 15.13%** 1: 4.51%	--
17	Model 1 + Tamoxifen Use	0: HR=1.89 (0.98-3.64) 1: HR=1.32 (0.68-2.55) 2: HR=1.00 (REF) p=0.1597	21	n=330 d=59	**0: 24.34%** 1: 0.75%	0: 8.00% 1: 5.04%

Model	Variable(s) in model	Mental Component Summary Score (MCS) (95% CI)	Difference in 'N'	Total in model (n) and total dead (d)	% change from Crude	% change from model 1
18	Model 1 + Smoking Status	0: HR=1.69 (0.87-3.26) 1: HR=1.40 (0.72-2.69) 2: HR=1.00 (REF) p=0.2992	21	n=330 d=59	**0: 11.18%** 1: 5.26%	0: 3.43% 1: 0.72%
19	Model 1 + Physical Activity	0: HR=1.75 (0.91-3.38) 1: HR=1.48 (0.76-2.89) 2: HR=1.00 (REF) p=0.2387	21	n=330 d=59	**0: 15.13%** **1: 11.28%**	0: 0.00% 1: 6.47%
Subset--Restricted to participants with BMI variable						
Crude	Mental Component Summary Score (MCS)	0: HR=1.31 (0.67-2.58) 1: HR=1.29 (0.66-2.52) 2: HR=1.00 (REF) p=0.6886	27	n=324 d=54	--	--
1	Age, Marital Status, & Tumor Stage	0: HR=1.46 (0.74-2.90) 1: HR=1.19 (0.60-2.35) 2: HR=1.00 (REF) p=0.5524	27	n=324 d=54	**0: 11.45%** 1: 7.75%	--

Model	Variable(s) in model	Mental Component Summary Score (MCS) (95% CI)	Difference in 'N'	Total in model (n) and total dead (d)	% change from Crude	% change from model 1
20	Model 1 + BMI	0: HR=1.49 (0.74-2.97) 1: HR=1.24 (0.63-2.45) 2: HR=1.00 (REF) p=0.5325	27	n=324 d=54	**0: 13.74%** 1: 3.88%	0: 2.05% 1: 4.20%
Subset--Restricted to participants with Tumor Subtype variable						
Crude	Mental Component Summary Score (MCS)	0: HR=1.16 (0.60-2.26) 1: HR=1.27 (0.67-2.40) 2: HR=1.00 (REF) p=0.7681	51	n=300 d=56	--	--
1	Age, Marital Status, & Tumor Stage	0: HR=1.36 (0.70-2.65) 1: HR=1.34 (0.70-2.55) 2: HR=1.00 (REF) p=0.5966	51	n=300 d=56	**0: 17.24%** 1: 5.51%	--
21	Model 1 + Tumor Subtype	0: HR=1.47 (0.75-2.89) 1: HR=1.37 (0.72-2.62) 2: HR=1.00 (REF) p=0.4811	51	n=300 d=56	**0: 26.72%** 1: 7.87%	0: 8.09% 1: 2.24%

*Model 1 is considered the 'base' for adjustment when PCS is the predictor.

Appendix O. Multivariable Modeling with Mental Component Score as the Predictor and Non-Cancer Mortality as the Outcome (*N* = 351)

Model	Variable(s) in model	Mental Component Summary Score (MCS) HR (95% CI)	Difference in 'N'	Total in model (n) and total dead (d)	% change from Crude	% change from model 1	% change from previous model
Crude	Mental Component Summary Score (MCS)	0: HR=1.45 (0.78-2.72) 1: HR=1.42 (0.76-2.64) 2: HR=1.00 (REF) p=0.4424	0	n=351 d=64	--	--	--
1	Age, Marital Status, & Tumor Stage	0: HR=1.73 (0.92-3.25) 1: HR=1.46 (0.78-2.72) 2: HR=1.00 (REF) p=0.2327	0	n=351 d=64	**0: 19.31%** 1: 2.82%	--	--
2	Model 1 + Race/Ethnicity	0: HR=1.73 (0.92-3.27) 1: HR=1.45 (0.78-2.72) 2: HR=1.00 (REF) p=0.2293	0	n=351 d=64	**0: 19.31%** 1: 2.11%	0: 0.00% 1: 0.68%	--
3	Model 1 + Race/Ethnicity + Treatment Type	0: HR=1.73 (0.92-3.26) 1: HR=1.39 (0.74-2.63) 2: HR=1.00 (REF) p=0.2377	0	n=351 d=64	**0: 19.31%** 1: 2.11%	0: 0.00% 1: 4.79%	0: 0.00% 1: 4.14%
4	Model 1 + Race/Ethnicity + Treatment Type + Comorbidities	0: HR=1.63 (0.84-3.14) 1: HR=1.40 (0.74-2.64) 2: HR=1.00 (REF) p=0.3328	0	n=351 d=64	**0: 12.41%** 1: 1.41%	0: 5.78% 1: 4.11%	0: 5.78% 1: 0.72%

Model	Variable(s) in model	Mental Component Summary Score (MCS) HR (95% CI)	Difference in 'N'	Total in model (n) and total dead (d)	% change from Crude	% change from model 1	% change from previous model
5	Model 1 + Race/Ethnicity + Treatment Type + Comorbidities + Optimism	0: HR=1.51 (0.77-2.96) 1: HR=1.31 (0.69-2.49) 2: HR=1.00 (REF) p=0.4828	0	n=351 d=64	0: 4.14% 1: 7.75%	**0: 12.72%** **1: 10.27%**	0: 7.36% 1: 6.43%
6	Model 1 + Race/Ethnicity + Treatment Type + Comorbidities + Optimism + Fear of Recurrence	0: HR=1.58 (0.80-3.10) 1: HR=1.37 (0.72-2.61) 2: HR=1.00 (REF) p=0.4022	0	n=351 d=64	0: 8.97% 1: 3.52%	0: 8.67% 1: 6.16%	0: 4.64% 1: 4.58%
7	Model 1 + Race/Ethnicity + Treatment Type + Comorbidities + Optimism + Fear of Recurrence + Number of Types of Confidants (Confide)	0: HR=1.62 (0.82-3.20) 1: HR=1.46 (0.76-2.80) 2: HR=1.00 (REF) p=0.3513	0	n=351 d=64	**0: 11.72%** 1: 2.82%	0: 6.36% 1: 0.00%	0: 2.53% 1: 6.57%
8	Model 1 + Race/Ethnicity + Treatment Type + Comorbidities + Optimism + Fear of Recurrence + Confide + Bodily Pain	0: HR=1.58 (0.79-3.14) 1: HR=1.44 (0.75-2.78) 2: HR=1.00 (REF) p=0.3822	0	n=351 d=64	0: 8.97% 1: 1.41%	0: 8.67% 1: 1.37%	0: 2.47% 1: 1.37%
9	Model 1 + Race/Ethnicity + Treatment Type + Comorbidities + Optimism + Fear of Recurrence + Confide + Bodily Pain + Perceived General Health	0: HR=1.40 (0.69-2.85) 1: HR=1.47 (0.76-2.83) 2: HR=1.00 (REF) p=0.4814	0	n=351 d=64	0: 3.45% 1: 3.52%	**0: 19.08%** 1: 0.68%	**0: 11.39%** 1: 2.08%

Model	Variable(s) in model	Mental Component Summary Score (MCS) HR (95% CI)	Difference in 'N'	Total in model (n) and total dead (d)	% change from Crude	% change from model 1	% change from previous model
Subset--Restricted to participants with Education variable							
Crude	Mental Component Summary Score (MCS)	0: HR=1.45 (0.78-2.72) 1: HR=1.36 (0.73-2.55) 2: HR=1.00 (REF) p=0.4751	1	n=350 d=63	--	--	--
1	Age, Marital Status, & Tumor Stage	0: HR=1.72 (0.91-3.23) 1: HR=1.41 (0.75-2.65) 2: HR=1.00 (REF) p=0.2464	1	n=350 d=63	**0: 18.62%** 1: 3.68%	--	--
10	Model 1 + Education	0: HR=1.72 (0.91-3.25) 1: HR=1.54 (0.81-2.94) 2: HR=1.00 (REF) p=0.2187	1	n=350 d=63	**0: 18.62%** **1: 13.24%**	0: 0.00% 1: 9.22%	--
11	Model 1 + Education + Race/Ethnicity	0: HR=1.73 (0.92-3.26) 1: HR=1.55 (0.81-2.97) 2: HR=1.00 (REF) p=0.2119	1	n=350 d=63	**0: 19.31%** **1: 13.97%**	0: 0.58% 1: 9.93%	0: 0.58% 1: 0.65%
12	Model 1 + Education + Race/Ethnicity + Treatment Type	0: HR=1.72 (0.91-3.25) 1: HR=1.48 (0.77-2.85) 2: HR=1.00 (REF) p=0.2310	1	n=350 d=63	**0: 18.62%** 1: 8.82%	0: 0.00% 1: 4.96%	0: 0.58% 1: 4.52%

Model	Variable(s) in model	Mental Component Summary Score (MCS) HR (95% CI)	Difference in 'N'	Total in model (n) and total dead (d)	% change from Crude	% change from model 1	% change from previous model
13	Model 1 + Education + Race/Ethnicity + Treatment Type + Comorbidities	0: HR=1.64 (0.85-3.17) 1: HR=1.47 (0.76-2.84) 2: HR=1.00 (REF) p=0.3079	1	n=350 d=63	**0: 13.10%** 1: 8.09%	0: 4.56% 1: 4.26%	0: 4.65% 1: 0.68%
14	Model 1 + Education + Race/Ethnicity + Treatment Type + Comorbidities + Optimism	0: HR=1.54 (0.78-3.02) 1: HR=1.39 (0.71-2.71) 2: HR=1.00 (REF) p=0.4303	1	n=350 d=63	0: 6.21% 1: 2.21%	**0: 10.47%** 1: 1.42%	0: 6.10% 1: 5.44%
15	Model 1 + Education + Race/Ethnicity + Treatment Type + Comorbidities + Optimism + Fear of Recurrence	0: HR=1.63 (0.83-3.20) 1: HR=1.49 (0.76-2.93) 2: HR=1.00 (REF) p=0.3310	1	n=350 d=63	**0: 12.41%** 1: 9.56%	0: 5.23% 1: 5.67%	0: 5.84% 1: 7.19%
16	Model 1 + Education + Race/Ethnicity + Treatment Type + Comorbidities + Optimism + Fear of Recurrence + Confide	0: HR=1.66 (0.84-3.27) 1: HR=1.57 (0.80-3.09) 2: HR=1.00 (REF) p=0.2923	1	n=350 d=63	**0: 14.48%** **1: 15.44%**	0: 3.49% **1: 11.35%**	0: 1.84% 1: 5.37%
17	Model 1 + Education + Race/Ethnicity + Treatment Type + Comorbidities + Optimism + Fear of Recurrence + Confide + Bodily Pain	0: HR=1.62 (0.81-3.21) 1: HR=1.56 (0.79-3.07) 2: HR=1.00 (REF) p=0.3205	1	n=350 d=63	**0: 11.72%** **1: 14.71%**	0: 5.81% **1: 10.64%**	0: 2.41% 1: 0.64%

Model	Variable(s) in model	Mental Component Summary Score (MCS) HR (95% CI)	Difference in 'N'	Total in model (n) and total dead (d)	% change from Crude	% change from model 1	% change from previous model
18	Model 1 + Education + Race/Ethnicity + Treatment Type + Comorbidities + Optimism + Fear of Recurrence + Confide+ Bodily Pain + Perceived General Health	0: HR=1.46 (0.72-2.96) 1: HR=1.58 (0.80-3.13) 2: HR=1.00 (REF) p=0.3839	1	n=350 d=63	0: 0.69% **1: 16.18%**	**0: 15.12%** **1: 12.06%**	0: 9.88% 1: 1.28%
Subset--Restricted to participants with Tumor Size variable							
Crude	Mental Component Summary Score (MCS)	0: HR=1.48 (0.79-2.77) 1: HR=1.43 (0.77-2.67) 2: HR=1.00 (REF) p=0.4136	10	n=341 d=64	--	--	--
1	Age, Marital Status, & Tumor Stage	0: HR=1.71 (0.91-3.22) 1: HR=1.45 (0.78-2.72) 2: HR=1.00 (REF) p=0.2438	10	n=341 d=64	**0: 15.54%** 1: 1.40%	--	--
19	Model 1 + Tumor Size	0: HR=1.71 (0.91-3.22) 1: HR=1.46 (0.78-2.74) 2: HR=1.00 (REF) p=0.2433	10	n=341 d=64	**0: 15.54%** 1: 2.10%	0: 0.00% 1: 0.69%	--

Model	Variable(s) in model	Mental Component Summary Score (MCS) HR (95% CI)	Difference in 'N'	Total in model (n) and total dead (d)	% change from Crude	% change from model 1	% change from previous model
20	Model 1 + Tumor Size + Race/Ethnicity	0: HR=1.72 (0.91-3.24) 1: HR=1.46 (0.78-2.74) 2: HR=1.00 (REF) p=0.2394	10	n=341 d=64	**0: 16.22%** 1: 2.10%	0: 0.58% 1: 0.69%	0: 0.58% 1: 0.00%
21	Model 1 + Tumor Size + Race/Ethnicity + Treatment Type	0: HR=1.72 (0.91-3.24) 1: HR=1.40 (0.74-2.63) 2: HR=1.00 (REF) p=0.2476	10	n=341 d=64	**0: 16.22%** 1: 2.10%	0: 0.58% 1: 3.45%	0: 0.00% 1: 4.11%
22	Model 1 + Tumor Size + Race/Ethnicity + Treatment Type + Comorbidities	0: HR=1.62 (0.84-3.12) 1: HR=1.40 (0.74-2.65) 2: HR=1.00 (REF) p=0.3409	10	n=341 d=64	0: 9.46% 1: 2.10%	0: 5.26% 1: 3.45%	0: 5.81% 1: 0.00%
23	Model 1 + Tumor Size + Race/Ethnicity + Treatment Type + Comorbidities + Optimism	0: HR=1.50 (0.77-2.95) 1: HR=1.31 (0.68-2.50) 2: HR=1.00 (REF) p=0.4875	10	n=341 d=64	0: 1.35% 1: 8.39%	**0: 12.28%** 1: 9.66%	0: 7.41% 1: 6.43%
24	Model 1 + Tumor Size + Race/Ethnicity + Treatment Type + Comorbidities + Optimism + Fear of Recurrence	0: HR=1.58 (0.80-3.10) 1: HR=1.38 (0.72-2.64) 2: HR=1.00 (REF) p=0.3992	10	n=341 d=64	0: 6.76% 1: 3.50%	0: 7.60% 1: 4.83%	0: 5.33% 1: 5.34%

Model	Variable(s) in model	Mental Component Summary Score (MCS) HR (95% CI)	Difference in 'N'	Total in model (n) and total dead (d)	% change from Crude	% change from model 1	% change from previous model
25	Model 1 + Tumor Size + Race/Ethnicity + Treatment Type + Comorbidities + Optimism + Fear of Recurrence + Confide	0: HR=1.62 (0.82-3.20) 1: HR=1.48 (0.77-2.85) 2: HR=1.00 (REF) p=0.3443	10	n=341 d=64	0: 9.46% 1: 3.50%	0: 5.26% 1: 2.07%	0: 2.53% 1: 7.25%
26	Model 1 + Tumor Size + Race/Ethnicity + Treatment Type + Comorbidities + Optimism + Fear of Recurrence + Confide + Bodily Pain	0: HR=1.58 (0.80-3.15) 1: HR=1.47 (0.76-2.84) 2: HR=1.00 (REF) p=0.3747	10	n=341 d=64	0: 6.76% 1: 2.80%	0: 7.60% 1: 1.38%	0: 2.47% 1: 0.68%
27	Model 1 + Tumor Size + Race/Ethnicity + Treatment Type + Comorbidities + Optimism + Fear of Recurrence + Confide+ Bodily Pain + Perceived General Health	0: HR=1.40 (0.69-2.85) 1: HR=1.49 (0.77-2.88) 2: HR=1.00 (REF) p=0.4631	10	n=341 d=64	0: 5.41% 1: 4.20%	**0: 18.13%** 1: 2.76%	**0: 11.39%** 1: 1.36%
Subset--Restricted to participants with Education and Tumor Size variables							
Crude	Mental Component Summary Score (MCS)	0: HR=1.48 (0.79-2.77) 1: HR=1.38 (0.74-2.78) 2: HR=1.00 (REF) p=0.4439	11	n=340 d=63	--	--	--

Model	Variable(s) in model	Mental Component Summary Score (MCS) HR (95% CI)	Difference in 'N'	Total in model (n) and total dead (d)	% change from Crude	% change from model 1	% change from previous model
1	Age, Marital Status, & Tumor Stage	0: HR=1.70 (0.90-3.20) 1: HR=1.41 (0.75-2.65) 2: HR=1.00 (REF) p=0.2587	11	n=340 d=63	0: 14.86% 1: 2.17%	--	--
28	Model 1 + Education + Tumor Size	0: HR=1.70 (0.90-3.21) 1: HR=1.52 (0.80-2.90) 2: HR=1.00 (REF) p=0.2355	11	n=340 d=63	**0: 14.86%** **1: 10.14%**	0: 0.00% 1: 7.80%	--
29	Model 1 + Education + Tumor Size + Race/Ethnicity	0: HR=1.71 (0.91-3.23) 1: HR=1.54 (0.80-2.94) 2: HR=1.00 (REF) p=0.2259	11	n=340 d=63	**0: 15.54%** **1: 11.59%**	0: 0.59% 1: 9.22%	0: 0.59% 1: 1.32%
30	Model 1 + Education + Tumor Size + Race/Ethnicity + Treatment Type	0: HR=1.71 (0.91-3.22) 1: HR=1.46 (0.76-2.81) 2: HR=1.00 (REF) p=0.2449	11	n=340 d=63	**0: 15.54%** 1: 5.80%	0: 0.59% 1: 3.55%	0: 0.00% 1: 5.19%
31	Model 1 + Education + Tumor Size + Race/Ethnicity + Treatment Type + Comorbidities	0: HR=1.63 (0.84-3.14) 1: HR=1.44 (0.74-2.78) 2: HR=1.00 (REF) p=0.3266	11	n=340 d=63	**0: 10.14%** 1: 4.35%	0: 4.12% 1: 2.13%	0: 4.68% 1: 1.37%

Model	Variable(s) in model	Mental Component Summary Score (MCS) HR (95% CI)	Difference in 'N'	Total in model (n) and total dead (d)	% change from Crude	% change from model 1	% change from previous model
32	Model 1 + Education + Tumor Size + Race/Ethnicity + Treatment Type + Comorbidities + Optimism	0: HR=1.53 (0.78-3.01) 1: HR=1.36 (0.70-2.66) 2: HR=1.00 (REF) p=0.4431	11	n=340 d=63	0: 3.38% 1: 1.45%	**0: 10.00%** 1: 3.55%	0: 6.13% 1: 5.56%
33	Model 1 + Education + Tumor Size + Race/Ethnicity + Treatment Type + Comorbidities + Optimism + Fear of Recurrence	0: HR=1.63 (0.83-3.19) 1: HR=1.47 (0.75-2.91) 2: HR=1.00 (REF) p=0.3372	11	n=340 d=63	**0: 10.14%** 1: 6.52%	0: 4.12% 1: 4.26%	0: 6.54% 1: 8.09%
34	Model 1 + Education + Tumor Size + Race/Ethnicity + Treatment Type + Comorbidities + Optimism + Fear of Recurrence + Confide	0: HR=1.66 (0.84-3.27) 1: HR=1.56 (0.79-3.08) 2: HR=1.00 (REF) p=0.2949	11	n=340 d=63	**0: 12.16%** **1: 13.04%**	0: 2.35% **1: 10.64%**	0: 1.84% 1: 6.12%
35	Model 1 + Education + Tumor Size + Race/Ethnicity + Treatment Type + Comorbidities + Optimism + Fear of Recurrence + Confide + Bodily Pain	0: HR=1.63 (0.82-3.24) 1: HR=1.56 (0.79-3.09) 2: HR=1.00 (REF) p=0.3136	11	n=340 d=63	**0: 10.14%** **1: 13.04%**	0: 4.12% **1: 10.64%**	0: 1.81% 1: 0.00%
36	Model 1 + Education + Tumor Size + Race/Ethnicity + Treatment Type + Comorbidities + Optimism + Fear of Recurrence + Confide + Bodily Pain + Perceived General Health	0: HR=1.47 (0.73-2.98) 1: HR=1.57 (0.79-3.12) 2: HR=1.00 (REF) p=0.3889	11	n=340 d=63	0: 0.68% **1: 13.77%**	**0: 13.53%** **1: 11.35%**	0: 9.82% 1: 0.64%

Model	Variable(s) in model	Mental Component Summary Score (MCS) HR (95% CI)	Difference in 'N'	Total in model (n) and total dead (d)	% change from Crude	% change from model 1	% change from previous model
Subset--Restricted to participants with Physical Activity variable (24-month follow-up)							
Crude	Mental Component Summary Score (MCS)	0: HR=1.52 (0.80-2.89) 1: HR=1.33 (0.70-2.56) 2: HR=1.00 (REF) p=0.4430	21	n=330 d=59	--	--	--
1	Age, Marital Status, & Tumor Stage	0: HR=1.75 (0.91-3/37) 1: HR=1.39 (0.72-2.68) 2: HR=1.00 (REF) p=0.2429	21	n=330 d=59	**0: 15.13%** 1: 4.51%	--	--
37	Model 1 + Physical Activity	0: HR=1.75 (0.91-3.38) 1: HR=1.48 (0.76-2.89) 2: HR=1.00 (REF) p=0.2387	21	n=330 d=59	**0: 15.13%** **1: 11.28%**	0: 0.00% 1: 6.47%	--
38	Model 1 + Physical Activity + Race/Ethnicity	0: HR=1.75 (0.91-3.39) 1: HR=1.48 (0.76-2.88) 2: HR=1.00 (REF) p=0.2369	21	n=330 d=59	**0: 15.13%** **1: 11.28%**	0: 0.00% 1: 6.47%	0: 0.00% 1: 0.00%
39	Model 1 + Physical Activity + Race/Ethnicity + Treatment Type	0: HR=1.76 (0.91-3.39) 1: HR=1.40 (0.71-2.76) 2: HR=1.00 (REF) p=0.2434	21	n=330 d=59	**0: 15.79%** 1: 5.26%	0: 0.57% 1: 0.72%	0: 0.57% 1: 5.41%

Model	Variable(s) in model	Mental Component Summary Score (MCS) HR (95% CI)	Difference in 'N'	Total in model (n) and total dead (d)	% change from Crude	% change from model 1	% change from previous model
40	Model 1 + Physical Activity + Race/Ethnicity + Treatment Type + Comorbidities	0: HR=1.64 (0.83-3.22) 1: HR=1.41 (0.72-2.78) 2: HR=1.00 (REF) p=0.3495	21	n=330 d=59	0: 7.89% 1: 6.02%	0: 6.29% 1: 1.44%	0: 6.82% 1: 0.72%
41	Model 1 + Physical Activity + Race/Ethnicity + Treatment Type + Comorbidities + Optimism	0: HR=1.49 (0.75-2.98) 1: HR=1.34 (0.68-2.66) 2: HR=1.00 (REF) p=0.5063	21	n=330 d=59	0: 1.97% 1: 0.75%	**0: 14.86%** 1: 3.60%	0: 9.15% 1: 4.96%
42	Model 1 + Physical Activity + Race/Ethnicity + Treatment Type + Comorbidities + Optimism + Fear of Recurrence	0: HR=1.57 (0.78-3.13) 1: HR=1.39 (0.70-2.76) 2: HR=1.00 (REF) p=0.4278	21	n=330 d=59	0: 3.29% 1: 4.51%	**0: 10.29%** 1: 0.00%	0: 5.37% 1: 3.73%
43	Model 1 + Physical Activity + Race/Ethnicity + Treatment Type + Comorbidities + Optimism + Fear of Recurrence + Confide	0: HR=1.64 (0.80-3.33) 1: HR=1.44 (0.72-2.88) 2: HR=1.00 (REF) p=0.3760	21	n=330 d=59	0: 7.89% 1: 8.27%	0: 6.29% 1: 3.60%	0: 4.46% 1: 3.60%
44	Model 1 + Physical Activity + Race/Ethnicity + Treatment Type + Comorbidities + Optimism + Fear of Recurrence + Confide + Bodily Pain	0: HR=1.57 (0.76-3.24) 1: HR=1.42 (0.71-2.85) 2: HR=1.00 (REF) p=0.4457	21	n=330 d=59	0: 3.29% 1: 6.77%	**0: 10.29%** 1: 2.16%	0: 4.27% 1: 1.39%

Model	Variable(s) in model	Mental Component Summary Score (MCS) HR (95% CI)	Difference in 'N'	Total in model (n) and total dead (d)	% change from Crude	% change from model 1	% change from previous model
45	Model 1 + Physical Activity + Race/Ethnicity + Treatment Type + Comorbidities + Optimism + Fear of Recurrence + Confide + Bodily Pain + Perceived General Health	0: HR=1.36 (0.64-2.92) 1: HR=1.40 (0.70-2.80) 2: HR=1.00 (REF) p=0.6065	21	n=330 d=59	0: 10.53% 1: 5.26%	**0: 22.29%** 1: 0.72%	**0: 13.38%** 1: 1.41%
Subset--Restricted to participants with Education, Tumor Size, and Physical Activity variables							
Crude	Mental Component Summary Score (MCS)	0: HR=1.55 (0.81-2.95) 1: HR=1.29 (0.67-2.48) 2: HR=1.00 (REF) p=0.4139	32	n=319 d=58	--	--	--
1	Age, Marital Status, & Tumor Stage	0: HR=1.72 (0.90-3.31) 1: HR=1.34 (0.69-2.59) 2: HR=1.00 (REF) p=0.2645	32	n=319 d=58	**0: 10.97%** 1: 3.88%	--	--
46	Model 1 + Education + Tumor Size + Physical Activity	0: HR=1.69 (0.87-3.27) 1: HR=1.47 (0.74-2.91) 2: HR=1.00 (REF) p=0.2818	32	n=319 d=58	0: 9.03% **1: 13.95%**	0: 1.74% 1: 9.70%	--

Model	Variable(s) in model	Mental Component Summary Score (MCS) HR (95% CI)	Difference in 'N'	Total in model (n) and total dead (d)	% change from Crude	% change from model 1	% change from previous model
47	Model 1 + Education + Tumor Size + Physical Activity + Race/Ethnicity	0: HR=1.69 (0.88-3.28) 1: HR=1.47 (0.74-2.91) 2: HR=1.00 (REF) p=0.2787	32	n=319 d=58	0: 9.03% **1: 13.95%**	0: 1.74% 1: 9.70%	0: 0.00% 1: 0.00%
48	Model 1 + Education + Tumor Size + Physical Activity + Race/Ethnicity + Treatment Type	0: HR=1.68 (0.87-3.24) 1: HR=1.37 (0.68-2.76) 2: HR=1.00 (REF) p=0.3048	32	n=319 d=58	0: 8.39% 1: 6.20%	0: 2.33% 1: 2.24%	0: 0.59% 1: 6.80%
49	Model 1 + Education + Tumor Size + Physical Activity + Race/Ethnicity + Treatment Type + Comorbidities	0: HR=1.59 (0.81-3.15) 1: HR=1.36 (0.67-2.73) 2: HR=1.00 (REF) p=0.3975	32	n=319 d=58	0: 2.58% 1: 5.43%	0: 7.56% 1: 1.49%	0: 5.36% 1: 0.73%
50	Model 1 + Education + Tumor Size + Physical Activity + Race/Ethnicity + Treatment Type + Comorbidities + Optimism	0: HR=1.49 (0.74-2.98) 1: HR=1.29 (0.64-2.61) 2: HR=1.00 (REF) p=0.5232	32	n=319 d=58	0: 3.87% 1: 0.00%	**0: 13.37%** 1: 3.73%	0: 6.29% 1: 5.15%
51	Model 1 + Education + Tumor Size + Physical Activity + Race/Ethnicity + Treatment Type + Comorbidities + Optimism + Fear of Recurrence	0: HR=1.59 (0.79-3.19) 1: HR=1.37 (0.67-2.77) 2: HR=1.00 (REF) p=0.4176	32	n=319 d=58	0: 2.58% 1: 6.20%	0: 7.56% 1: 2.24%	0: 6.71% 1: 6.20%

Model	Variable(s) in model	Mental Component Summary Score (MCS) HR (95% CI)	Difference in 'N'	Total in model (n) and total dead (d)	% change from Crude	% change from model 1	% change from previous model
52	Model 1 + Education + Tumor Size + Physical Activity + Race/Ethnicity + Treatment Type + Comorbidities + Optimism + Fear of Recurrence + Confide	0: HR=1.64 (0.81-3.36) 1: HR=1.41 (0.69-2.88) 2: HR=1.00 (REF) p=0.3824	32	n=319 d=58	0: 5.81% 1: 9.30%	0: 4.65% 1: 5.22%	0: 3.14% 1: 2.92%
53	Model 1 + Education + Tumor Size + Physical Activity + Race/Ethnicity + Treatment Type + Comorbidities + Optimism + Fear of Recurrence + Confide + Bodily Pain	0: HR=1.61 (0.77-3.35) 1: HR=1.40 (0.68-2.87) 2: HR=1.00 (REF) p=0.4303	32	n=319 d=58	0: 3.87% 1: 8.53%	0: 6.40% 1: 4.48%	0: 1.83% 1: 0.71%
54	Model 1 + Education + Tumor Size + Physical Activity + Race/Ethnicity + Treatment Type + Comorbidities + Optimism + Fear of Recurrence + Confide + Bodily Pain + Perceived General Health	0: HR=1.44 (0.67-3.09) 1: HR=1.73 (0.67-2.83) 2: HR=1.00 (REF) p=0.5886	32	n=319 d=58	0: 7.10% **1: 34.11%**	**0: 16.28%** **1: 29.10%**	**0: 10.56%** **1: 23.57%**
Subset--Restricted to participants with BMI variable							
Crude	Mental Component Summary Score (MCS)	0: HR=1.31 (0.67-2.58) 1: HR=1.29 (0.66-2.52) 2: HR=1.00 (REF) p=0.6886	27	n=324 d=54	--	--	--

Model	Variable(s) in model	Mental Component Summary Score (MCS) HR (95% CI)	Difference in 'N'	Total in model (n) and total dead (d)	% change from Crude	% change from model 1	% change from previous model
1	Age, Marital Status, & Tumor Stage	0: HR=1.46 (0.74-2.90) 1: HR=1.19 (0.60-2.35) 2: HR=1.00 (REF) p=0.5524	27	n=324 d=54	**0: 11.45%** 1: 7.75%	--	--
55	Model 1 + BMI	0: HR=1.49 (0.74-2.97) 1: HR=1.24 (0.63-2.45) 2: HR=1.00 (REF) p=0.5325	27	n=324 d=54	**0: 13.74%** 1: 3.88%	0: 2.05% 1: 4.20%	--
56	Model 1 + BMI + Race/Ethnicity	0: HR=1.48 (0.74-2.97) 1: HR=1.24 (0.62-2.45) 2: HR=1.00 (REF) p=0.5416	27	n=324 d=54	**0: 12.98%** 1: 3.88%	0: 1.37% 1: 4.20%	0: 0.67% 1: 0.00%
57	Model 1 + BMI + Race/Ethnicity + Treatment Type	0: HR=1.45 (0.72-2.91) 1: HR=1.14 (0.57-2.29) 2: HR=1.00 (REF) p=0.5686	27	n=324 d=54	**0: 10.69%** **1: 11.63%**	0: 0.68% 1: 0.00%	0: 2.03% 1: 8.06%
58	Model 1 + BMI + Race/Ethnicity + Treatment Type + Comorbidities	0: HR=1.43 (0.70-2.92) 1: HR=1.14 (0.57-2.28) 2: HR=1.00 (REF) p=0.6182	27	n=324 d=54	0: 9.16% **1: 11.63%**	0: 2.05% 1: 4.20%	0: 1.38% 1: 0.00%

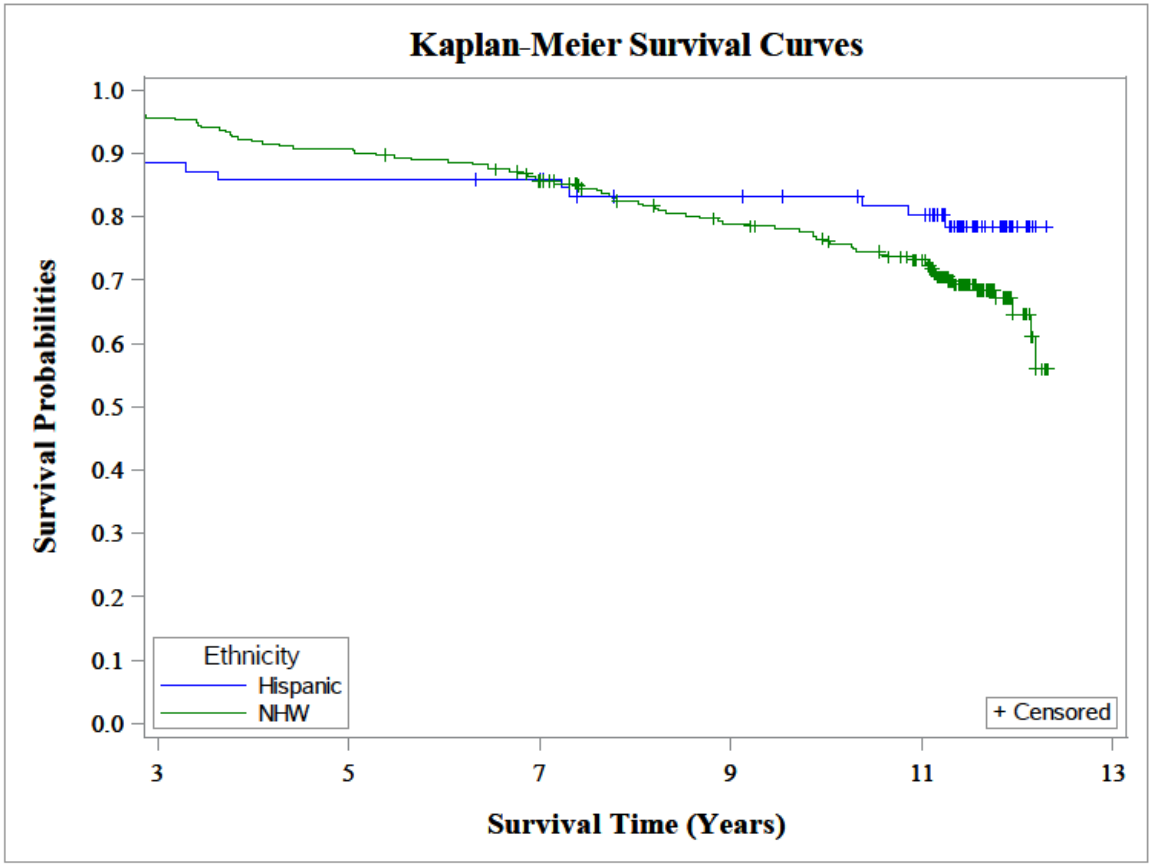
Model	Variable(s) in model	Mental Component Summary Score (MCS) HR (95% CI)	Difference in 'N'	Total in model (n) and total dead (d)	% change from Crude	% change from model 1	% change from previous model
59	Model 1 + BMI + Race/Ethnicity + Treatment Type + Comorbidities + Optimism	0: HR=1.30 (0.63-2.71) 1: HR=1.03 (0.51-2.09) 2: HR=1.00 (REF) p=0.7401	27	n=324 d=54	0: 0.76% **1: 20.16%**	**0: 10.96%** **1: 13.45%**	0: 9.09% 1: 9.65%
60	Model 1 + BMI + Race/Ethnicity + Treatment Type + Comorbidities + Optimism + Fear of Recurrence	0: HR=1.38 (0.66-2.87) 1: HR=1.13 (0.56-2.28) 2: HR=1.00 (REF) p=0.6824	27	n=324 d=54	0: 5.34% **1: 12.40%**	0: 5.48% 1: 5.04%	0: 6.15% 1: 9.71%
61	Model 1 + BMI + Race/Ethnicity + Treatment Type + Comorbidities + Optimism + Fear of Recurrence + Confide	0: HR=1.39 (0.67-2.89) 1: HR=1.14 (0.57-2.31) 2: HR=1.00 (REF) p=0.6816	27	n=324 d=54	0: 6.11% **1: 11.63%**	0: 4.79% 1: 6.72%	0: 0.72% 1: 0.88%
62	Model 1 + BMI + Race/Ethnicity + Treatment Type + Comorbidities + Optimism + Fear of Recurrence + Confide + Bodily Pain	0: HR=1.35 (0.64-2.83) 1: HR=1.12 (0.55-2.28) 2: HR=1.00 (REF) p=0.7242	27	n=324 d=54	0: 3.05% **1: 13.18%**	0: 7.53% 1: 5.88%	0: 2.88% 1: 1.75\%
63	Model 1 + BMI + Race/Ethnicity + Treatment Type + Comorbidities + Optimism + Fear of Recurrence + Confide + Bodily Pain + Perceived General Health	0: HR=1.17 (0.54-2.51) 1: HR=1.10 (0.54-2.23) 2: HR=1.00 (REF) p=0.9232	27	n=324 d=54	**0: 10.69%** **1: 14.73%**	**0: 19.86%** 1: 7.56%	**0: 13.33%** 1: 1.79%

Model	Variable(s) in model	Mental Component Summary Score (MCS) HR (95% CI)	Difference in 'N'	Total in model (n) and total dead (d)	% change from Crude	% change from model 1	% change from previous model
Subset--Restricted to participants with Education, Tumor Size, Physical Activity, and BMI variables							
Crude	Mental Component Summary Score (MCS)	0: HR=1.41 (0.70-2.84) 1: HR=1.20 (0.59-2.43) 2: HR=1.00 (REF) p=0.6282	56	n=246 d=49	--	--	--
1	Age, Marital Status, & Tumor Stage	0: HR=1.59 (0.78-3.23) 1: HR=1.20 (0.59-2.44) 2: HR=1.00 (REF) p=0.4238	56	n=246 d=49	**0: 12.77%** 1: 0.00%	--	--
64	Model 1 + Education + Tumor Size + Physical Activity + BMI	0: HR=1.54 (0.75-3.17) 1: HR=1.28 (0.61-2.68) 2: HR=1.00 (REF) p=0.5037	56	n=246 d=49	0: 9.22% 1: 6.67%	0: 3.14% 1: 6.67%	--
65	Model 1 + Education + Tumor Size + Physical Activity + BMI + Race/Ethnicity	0: HR=1.54 (0.75-3.19) 1: HR=1.28 (0.61-2.69) 2: HR=1.00 (REF) p=0.5055	56	n=246 d=49	0: 9.22% 1: 6.67%	0: 3.14% 1: 6.67%	0: 0.00% 1: 0.00%
66	Model 1 + Education + Tumor Size + Physical Activity + BMI + Race/Ethnicity + Treatment Type	0: HR=1.52 (0.74-3.15) 1: HR=1.15 (0.54-2.44) 2: HR=1.00 (REF) p=0.5136	56	n=246 d=49	0: 7.80% 1: 4.17%	0: 4.40% 1: 4.17%	0: 1.30% **1: 10.16%**

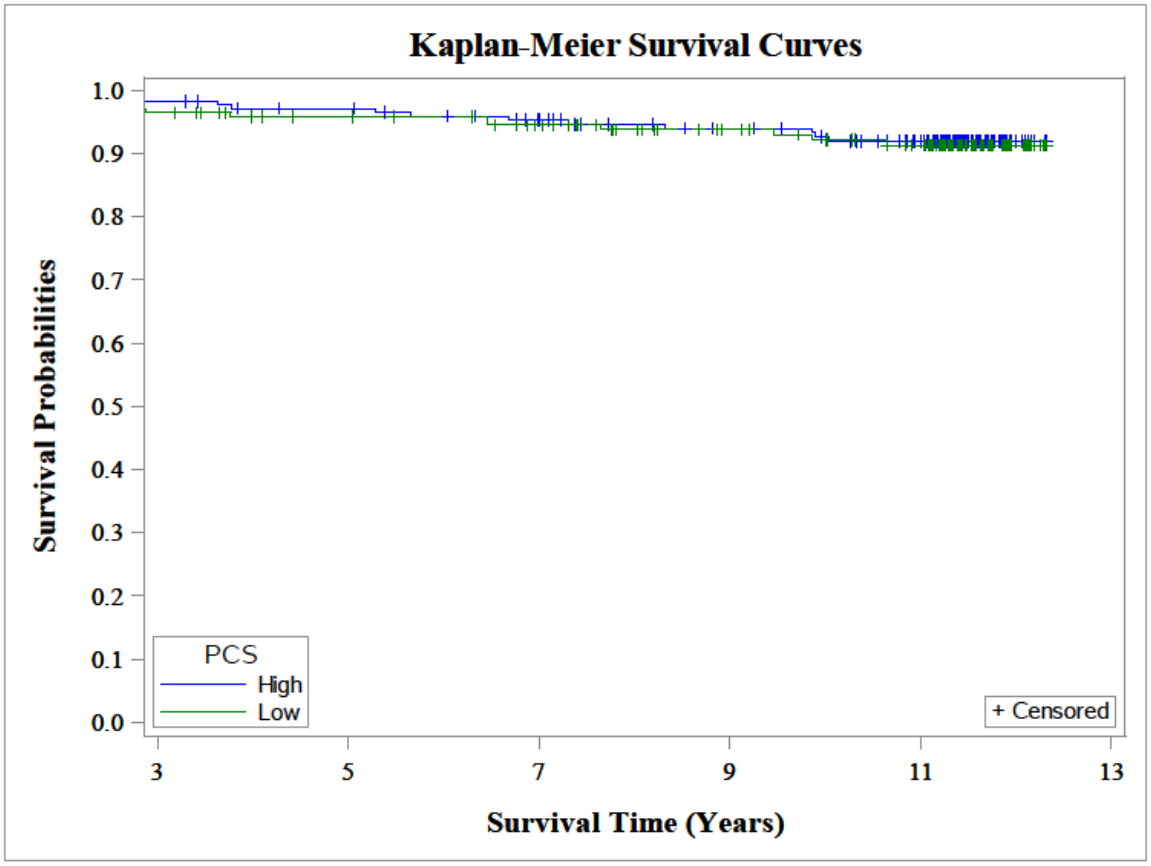
Model	Variable(s) in model	Mental Component Summary Score (MCS) HR (95% CI)	Difference in 'N'	Total in model (n) and total dead (d)	% change from Crude	% change from model 1	% change from previous model
67	Model 1 + Education + Tumor Size + Physical Activity + BMI + Race/Ethnicity + Treatment Type + Comorbidities	0: HR=1.46 (0.69-3.07) 1: HR=1.17 (0.55-2.49) 2: HR=1.00 (REF) p=0.6101	56	n=246 d=49	0: 3.55% 1: 2.50%	0: 8.18% 1: 2.50%	0: 3.95% 1: 1.74%
68	Model 1 + Education + Tumor Size + Physical Activity + BMI + Race/Ethnicity + Treatment Type + Comorbidities + Optimism	0: HR=1.30 (0.61-2.80) 1: HR=1.09 (0.51-2.32) 2: HR=1.00 (REF) p=0.7921	56	n=246 d=49	0: 7.80% 1: 9.17%	**0: 18.24%** 1: 9.17%	**0: 10.96%** 1: 6.84%
69	Model 1 + Education + Tumor Size + Physical Activity + BMI + Race/Ethnicity + Treatment Type + Comorbidities + Optimism + Fear of Recurrence	0: HR=1.39 (0.64-3.01) 1: HR=1.17 (0.54-2.50) 2: HR=1.00 (REF) p=0.7031	56	n=246 d=49	0: 1.42% 1: 2.50%	**0: 12.58%** 1: 2.50%	0: 6.92% 1: 7.34%
70	Model 1 + Education + Tumor Size + Physical Activity + BMI + Race/Ethnicity + Treatment Type + Comorbidities + Optimism + Fear of Recurrence + Confide	0: HR=1.41 (0.65-3.06) 1: HR=1.17 (0.55-2.51) 2: HR=1.00 (REF) p=0.6880	56	n=246 d=49	0: 0.00% 1: 2.50%	**0: 11.32%** 1: 2.50%	0: 1.44% 1: 0.00%
71	Model 1 + Education + Tumor Size + Physical Activity + BMI + Race/Ethnicity + Treatment Type + Comorbidities + Optimism + Fear of Recurrence + Confide + Bodily Pain	0: HR=1.36 (0.61-2.99) 1: HR=1.17 (0.54-2.52) 2: HR=1.00 (REF) p=0.7533	56	n=246 d=49	0: 3.55% 1: 2.50%	**0: 14.47%** 1: 2.50%	0: 3.55% 1: 0.00%

Model	Variable(s) in model	Mental Component Summary Score (MCS) HR (95% CI)	Difference in 'N'	Total in model (n) and total dead (d)	% change from Crude	% change from model 1	% change from previous model
72	Model 1 + Education + Tumor Size + Physical Activity + BMI + Race/Ethnicity + Treatment Type + Comorbidities + Optimism + Fear of Recurrence + Confide + Bodily Pain + Perceived General Health	0: HR=1.17 (0.52-2.67) 1: HR=1.10 (0.51-2.38) 2: HR=1.00 (REF) p=0.9274	56	n=246 d=49	**0: 17.02%** 1: 8.33%	**0: 26.42%** 1: 8.33%	**0: 13.97%** 1: 5.98%

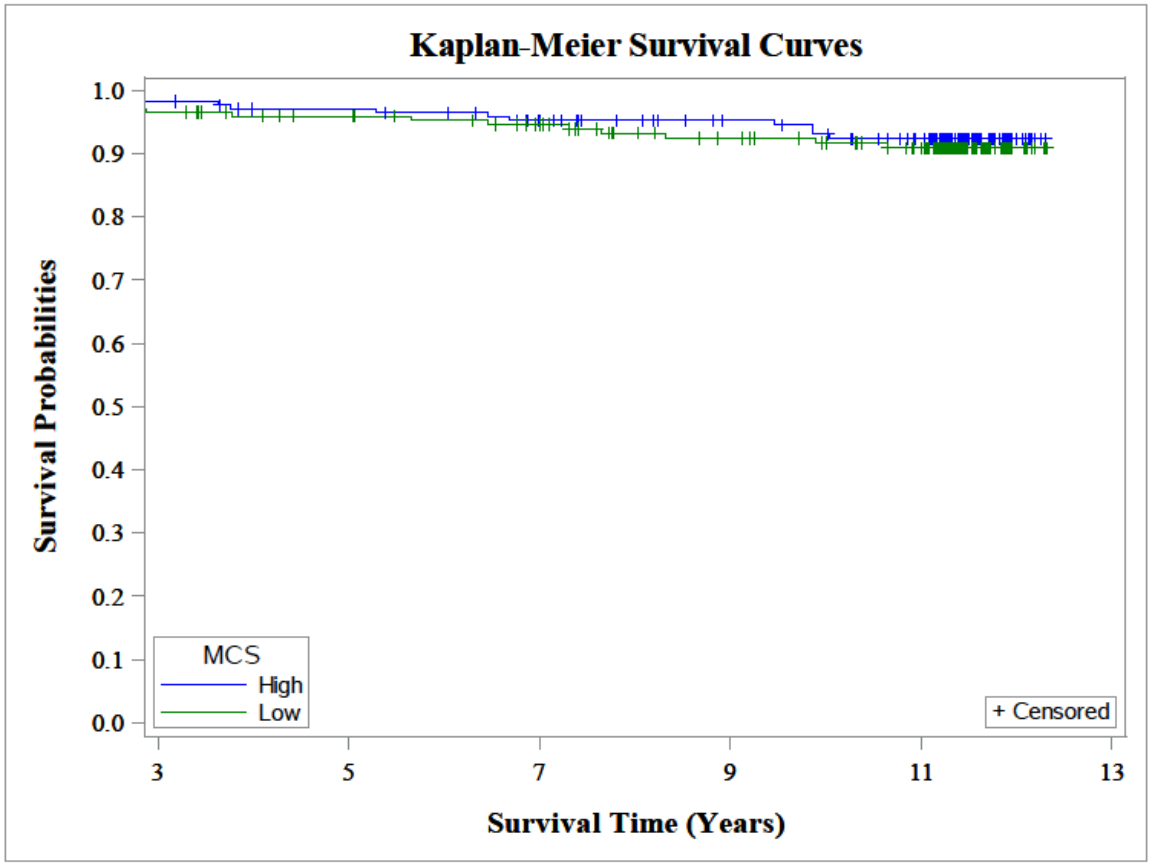
Appendix P: Kaplan-Meier Curves: (All-Cause) Survival Probability Estimates for Ethnicity



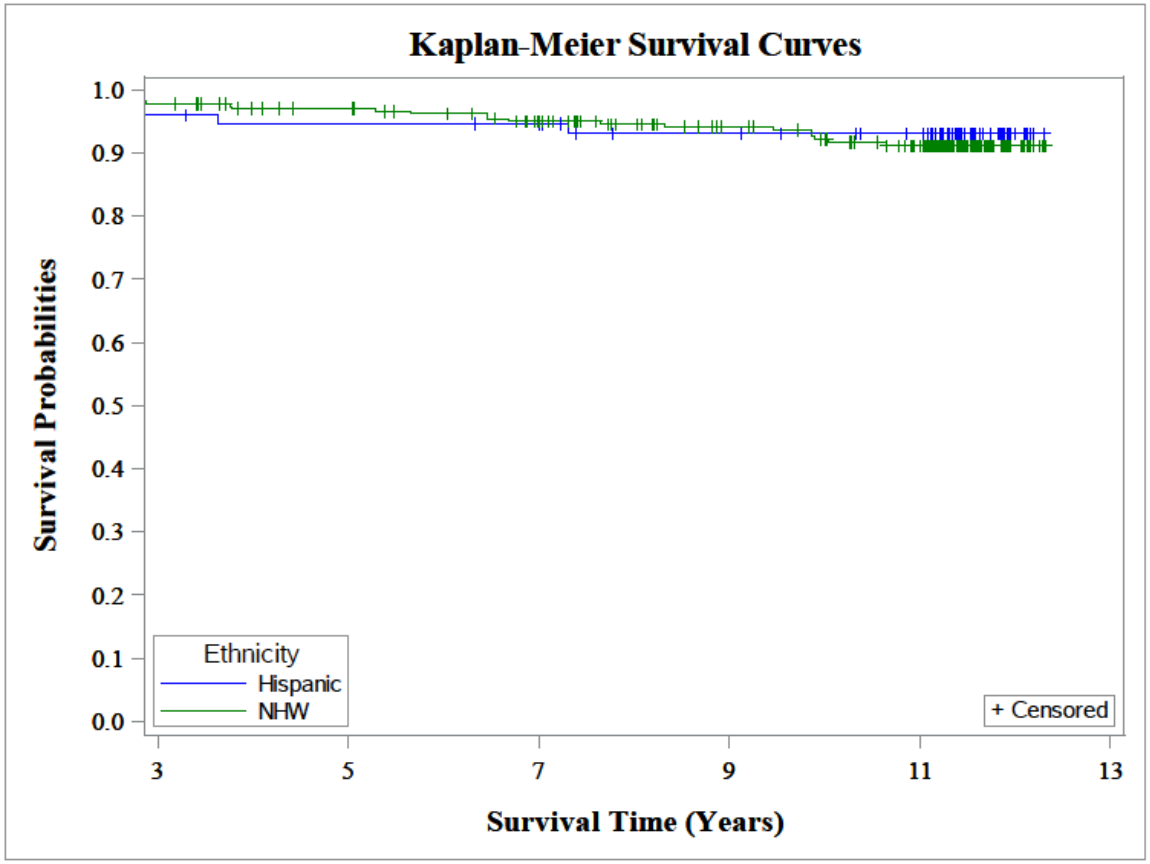
Appendix Q: Kaplan-Meier Curves: (BCS) Survival Probability Estimates for PCS Tertiles



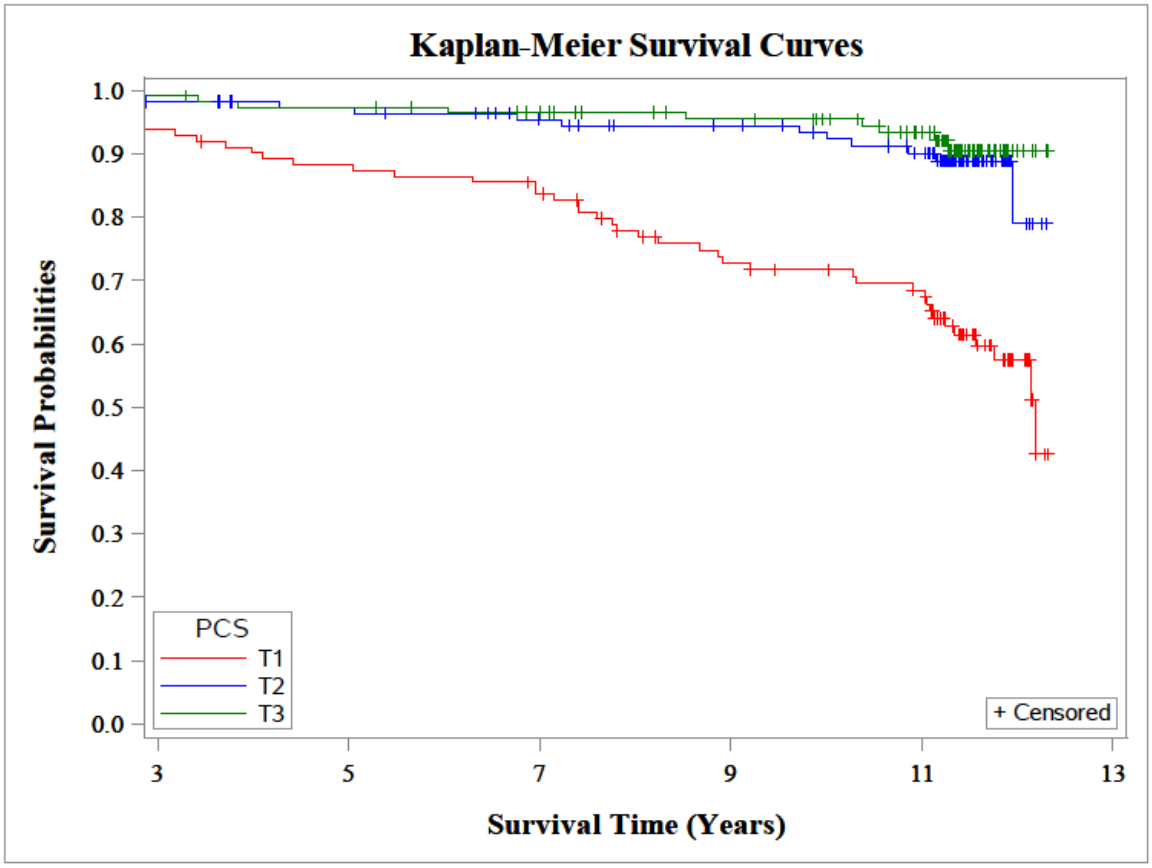
Appendix R: Kaplan-Meier Curves: (BCS) Survival Probability Estimates for MCS Tertiles



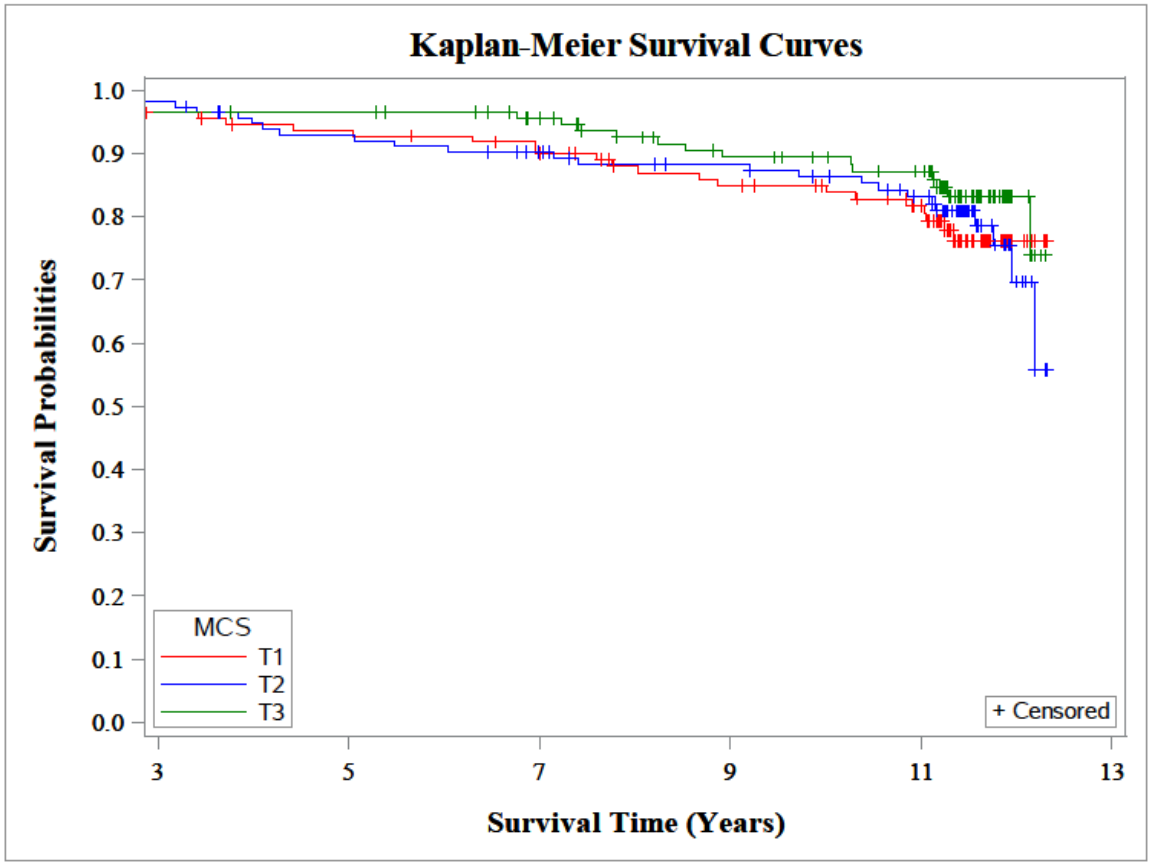
Appendix S: Kaplan-Meier Curves: (BCS) Survival Probability Estimates for Ethnicity



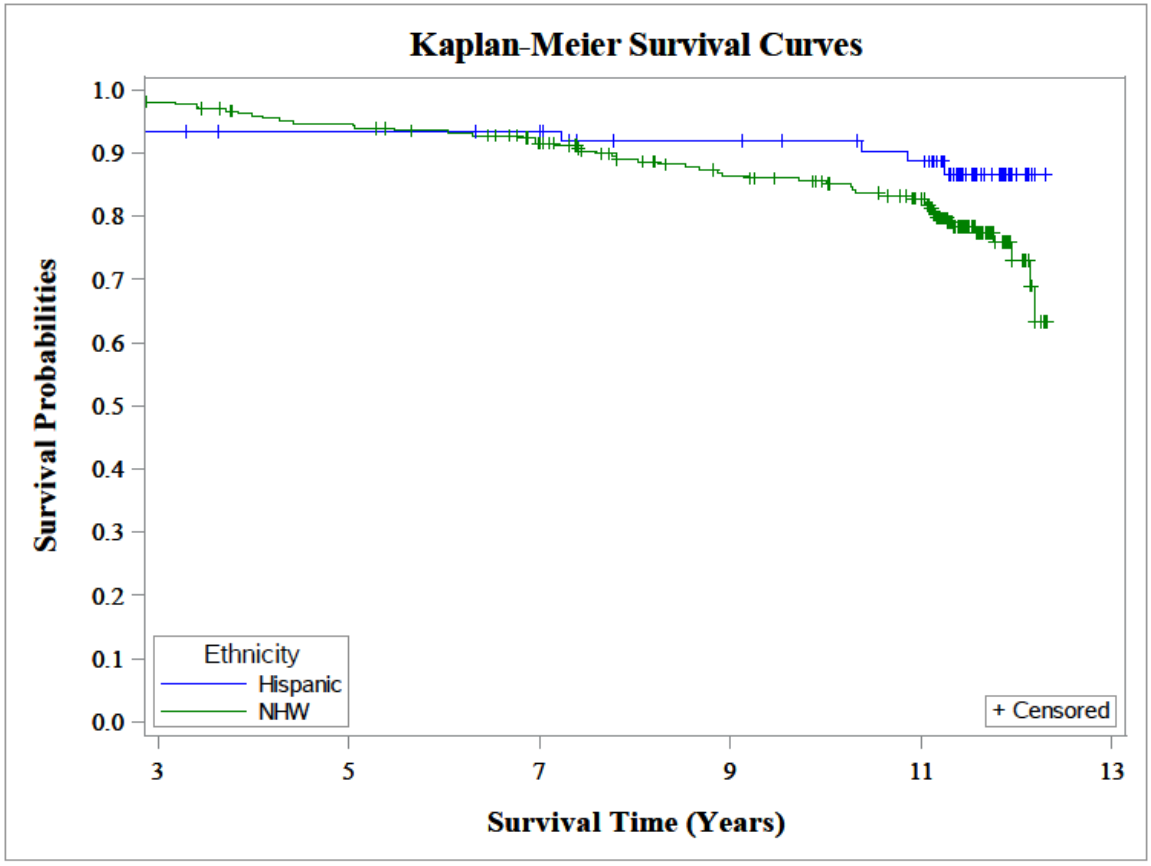
Appendix T: Kaplan-Meier Curves (Non-Cancer) Survival Probability Estimates for PCS Tertiles



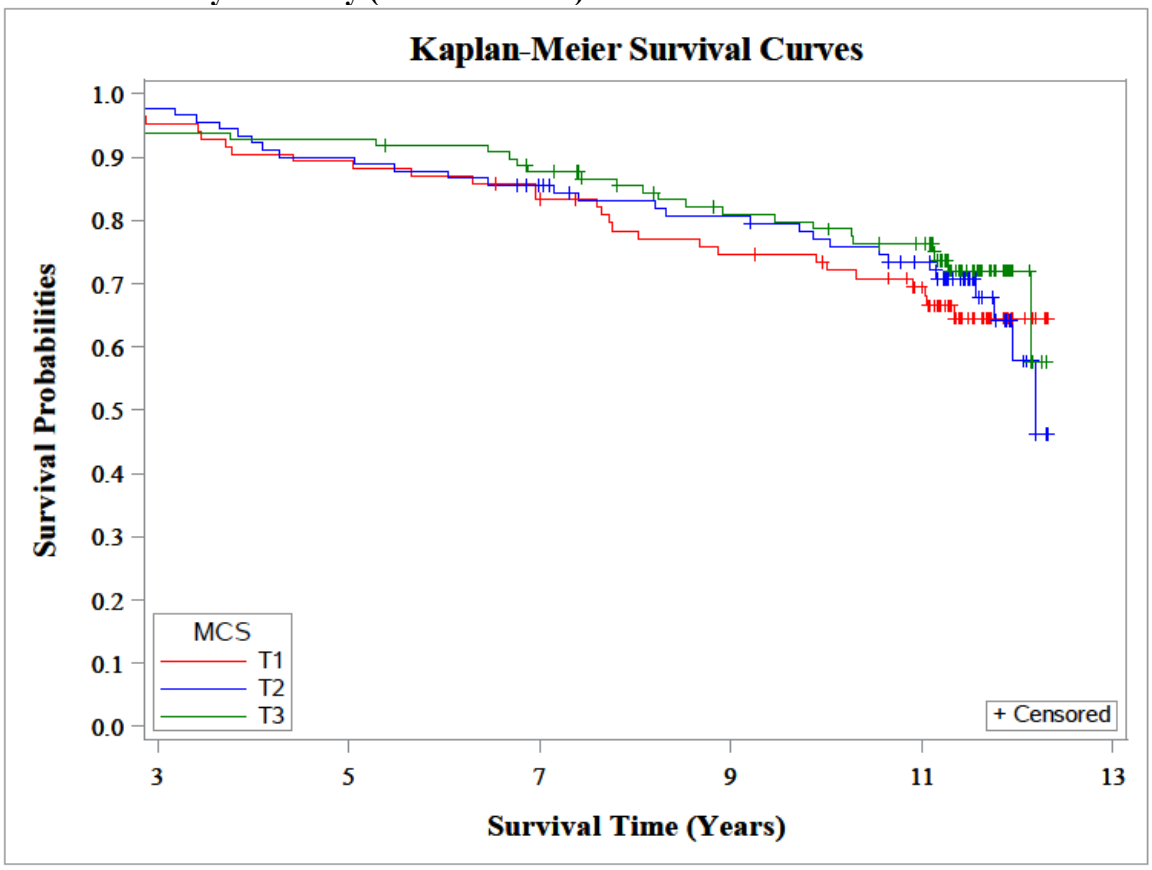
Appendix U: Kaplan-Meier Curves: (Non-Cancer) Survival Probability Estimates for MCS Tertiles



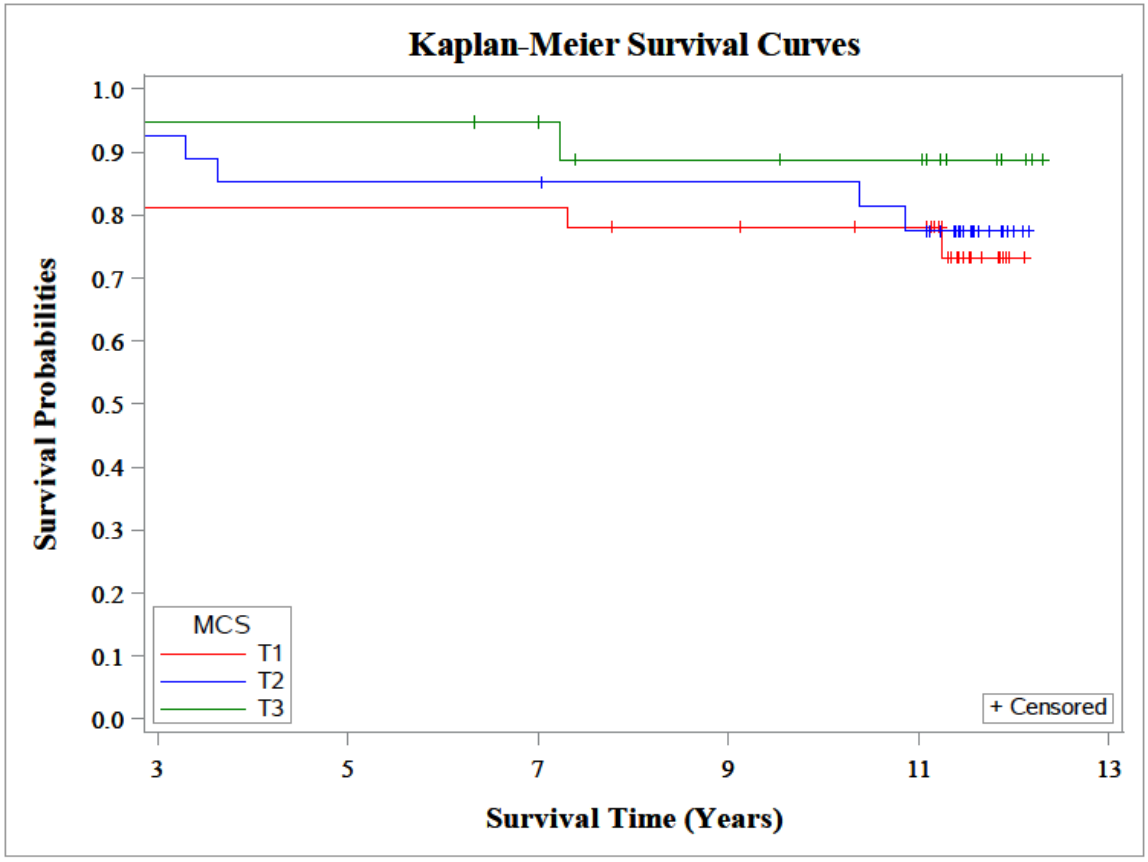
Appendix V: Kaplan-Meier Curves: (Non-Cancer) Survival Probability Estimates for Ethnicity



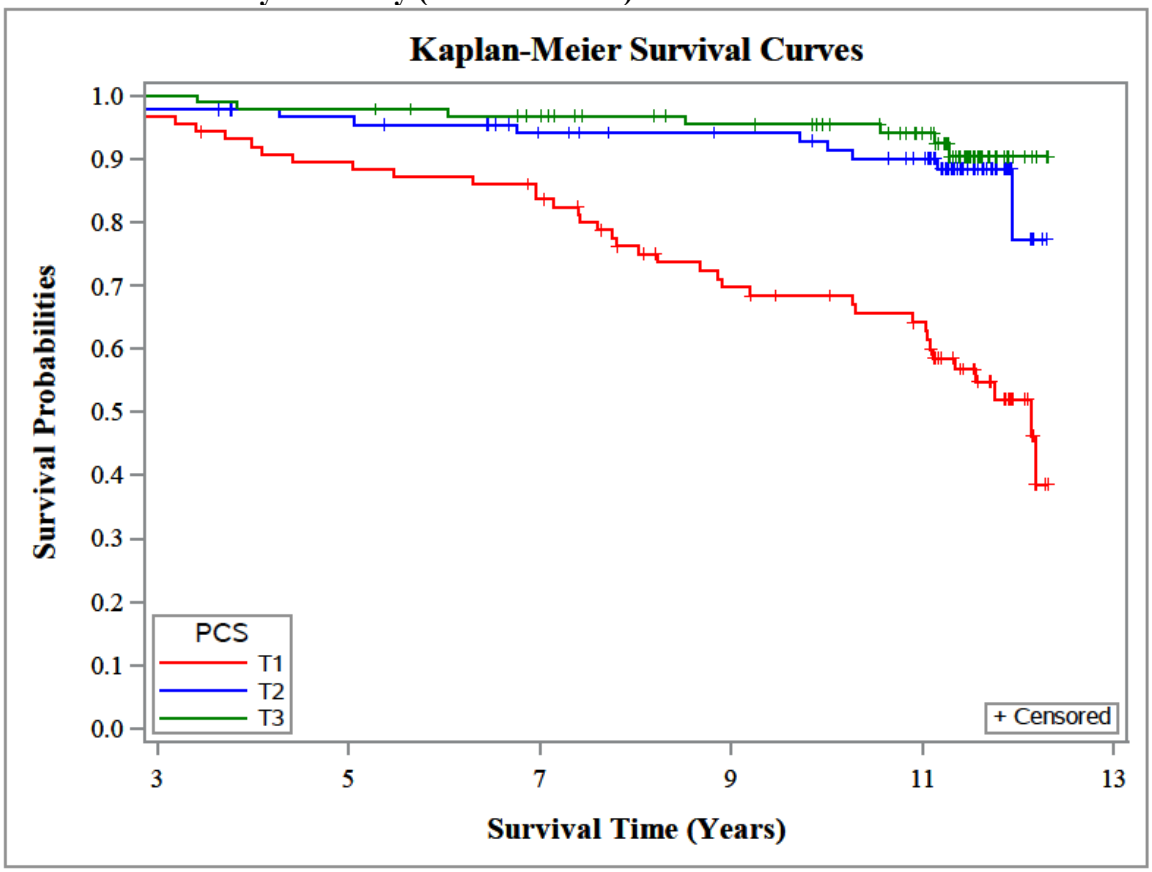
Appendix W: Kaplan-Meier Curves: (All-Cause) Survival Probability Estimates for MCS Tertiles by Ethnicity (NHW Women)



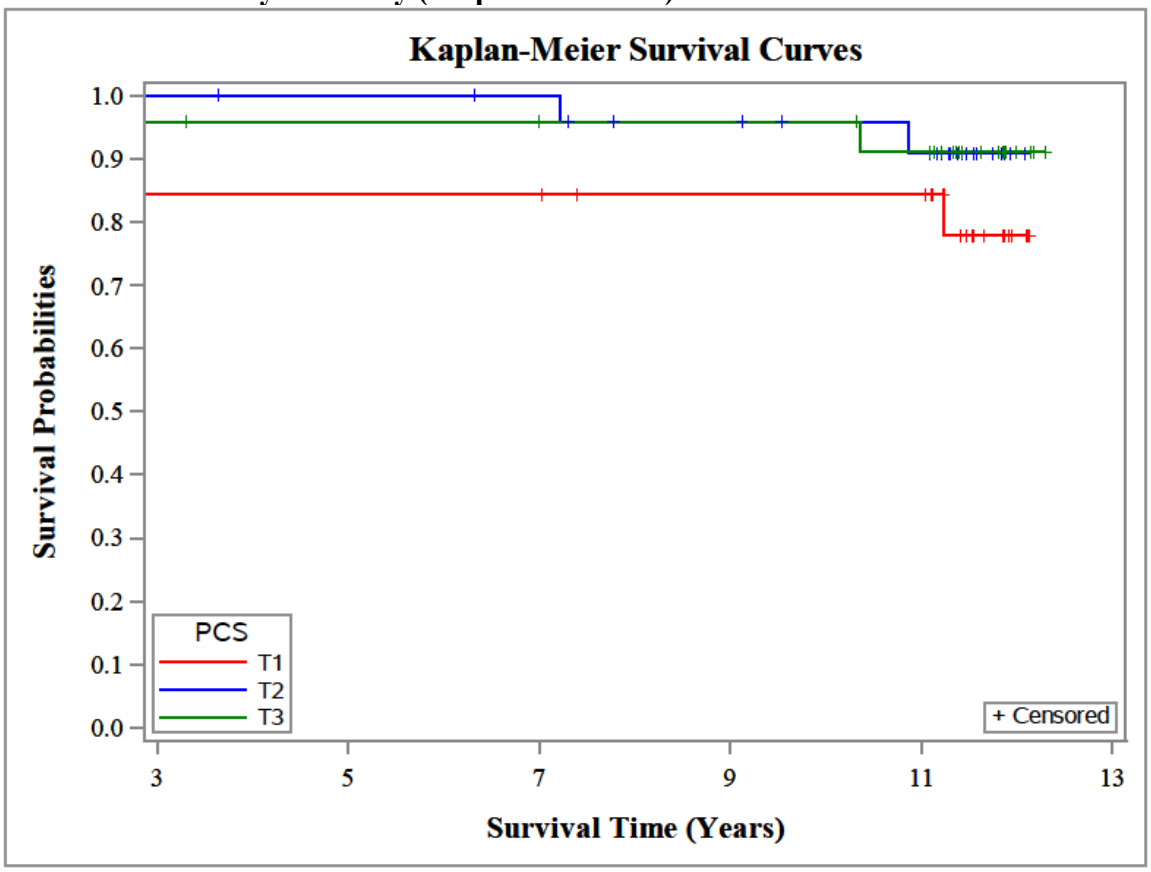
Appendix X: Kaplan-Meier Curves: (All-Cause) Survival Probability Estimates for MCS Tertiles by Ethnicity (Hispanic Women)



Appendix Y: Kaplan-Meier Curves: (Non-Cancer) Survival Probability Estimates for MCS Tertiles by Ethnicity (NHW Women)



Appendix Z: Kaplan-Meier Curves: (Non-Cancer) Survival Probability Estimates for MCS Tertiles by Ethnicity (Hispanic Women)



CURRICULUM VITAE

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EDUCATION

Master's of Science, Epidemiology, Expected: August 2018
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Bachelor's of Science, Public Health
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Summa cum laude

PROFESSIONAL EXPERIENCE

2017-	Robertson, R. M., Bhatnagar, A. (PIs), et al.; AHA Tobacco Regulation and Addiction Center (A-TRAC) (three project areas—1. Cardiovascular Toxicity of Tobacco Products, 2. Cardiovascular Injury Due to Tobacco Use, and 3. Perception of Tobacco Use in Vulnerable Populations). Graduate Assistant for Project 3. National Institutes of Health (NIH) and Food and Drug Administration (FDA), $19.6 million, 2013-2018, Term: February 2017 – Present.
2017-18	Graduate Research Assistant, Department of Environmental and Occupational Health Sciences, University of Louisville, Term: August 2017 – January 2018.
2018-18	Graduate Research Assistant on a National Institutes of Health (NIH) funded grant (1R15ES028440-01) for the "Developmental CSE: Impact of Intestinal Bacterial Community Development", Term: January 2017 – March 2018.

2018- Volunteer Research Assistant, Department of Communications, University of Louisville, Term: May 2018 – Present.

PUBLICATIONS

Manuscript Published

2018 Hart, J. L., Walker, K. L., Sears, C. G., Tompkins, L. K., Lee, A. S., **Mattingly, D. T.**, Groom, A., Landry, R., Giachello, A. L., Payne, T. J., Kesh, A., Siu, A., Smith, C., Robertson, R. M. (2018, January). "The 'State' of Tobacco: Perceptions of Tobacco among Appalachian Youth in Kentucky". *Tobacco Prevention & Cessation.*

Manuscripts in Submission

2018 Sims, M., Glover L. M., Ma, J., Kesh, A., Tompkins, L., Hart, J. L., **Mattingly, D. T.**, Walker, K., Robertson R. M., Payne, T. J. (2018, February). "The Social Patterning of Electronic Nicotine Delivery System Use among US Adults". *Preventive Medicine.* Manuscript Submitted.

2018 Ma, J., Hart, J., Walker, K., Giachello, A., Groom, A., Landry, R., Tompkins, L., Vu, T-H., **Mattingly, D.**, Sears, C., Kesh, A., Hall, M., Robertson, R. M., Payne, T. (2018, April). "Perceived Health Risks of Electronic Nicotine Delivery Systems (ENDS) Users: The Role of Cigarette Smoking Status". *Addictive Behaviors.* Manuscript Submitted.

2018 Landry, R., Groom, A., Vu, T-H., Stokes, A., Berry K., Kesh, A., Hart, J., Walker, K., Giachello, A., Sears, C., McGlasson, K., Tompkins, L., **Mattingly, D.**, Robertson, R., Payne, T. (2018, June). "The Role of Flavors in Electronic Cigarette Initiation and Use Patterns among U.S. Adults". *Tobacco Control.* Manuscript Submitted.

Manuscripts in Preparation

2018 **Mattingly, D. T.,** Tompkins, L. K., Rai, J., Sears, C. G., Walker, K. L., & Hart, J. L. (2018, January). "Tobacco Use and Harm Perceptions among Appalachian Youth". Manuscript to be submitted in August.

2018 **Mattingly, D. T.,** Tompkins, L. K., Rai, J., Sears, C. G., Walker, K. L., & Hart, J. L. (2018, January). "Tobacco Use and Communication Channel Preferences among Appalachian Youth". Manuscript to be submitted in August.

Presentations and Papers

2016 **Mattingly, D. T.**, Boone, S. D., Heitz, A. E., Baumgartner, K. B., & Baumgartner, R. N., (2016, October). "Health Behaviors and Breast Cancer Risk in Non-Hispanic White & Hispanic Women". Paper presented at the University of Louisville "Research!Louisville" conference, Louisville, KY.

2016 Heitz, A. E., Boone, S. D., **Mattingly D. T.**, Baumgartner, R. N. & Baumgartner, K. B., (2016, March). "Healthy Lifestyle Impact on Breast Cancer-Specific and All-Cause Mortality". Paper presented at the University of Louisville "Research!Louisville" conference, Louisville, KY.

2016 Heitz, A. E., Boone, S. D., **Mattingly D. T.**, Baumgartner, R. N. & Baumgartner, K. B., (2016, March). "Healthy Lifestyle Impact on Breast Cancer-Specific and All-Cause Mortality". Paper presented at the Posters-at-the-Capitol conference, Frankfort, KY.

2017 **Mattingly, D. T**., Tompkins, L. K., Sears, C. G., Walker, K. L., & Hart, J. L. (2017, September). "Tobacco Communication, Tobacco Culture: Celebrating Successes and Examining Shortcomings". Paper presented at the annual meeting of the Kentucky Communication Association, Carrollton, KY.

2017 Ma, J. Z., Hart, J. L., Walker, K. L., Giachello, A. L., Groom, A., Landry, R. L., Tompkins, L. K., Vu, T-H., **Mattingly, D. T**., Sears, C. G., Kesh, A., Robertson, R. M., & Payne, T. J. (2017, October). "Characterization of Current Adult ENDS Users by Cigarette Smoking Status". Paper presented at the NIH Tobacco Regulatory Science Conference, Bethesda, Maryland.

2017 **Mattingly, D. T.,** Tompkins, L. K., Sears, C. G., Walker, K. L., & Hart, J. L. (2017, October). "Tobacco Use and Harm Perceptions among Appalachian Youth". Paper presented at the NIH Tobacco Regulatory Science Conference, Bethesda, Maryland.

2017 Stokes, A., McGlasson, K. L., Groom, A., Landry, R. L., Vu, T-H., Hart, J. L., Walker, K. L., Payne, T. J., Giachello, A. L., Sears, C. G., Kesh, A., Tompkins, L., K., **Mattingly, D. T**., & Rose Marie Robertson, R. M. (2017, October). "The Role of Flavors in E-cigarette Uptake and Use Patterns: Results from a Survey of US Adults". Paper presented at the NIH Tobacco Regulatory Science Conference, Bethesda, Maryland.

2017 Vu, T-H., Hart, J. L., Walker, K. L., Landry, R., Groom, A., Sears, C. G., Tompkins, L. K., **Mattingly, D. T**., & Anshula Kesh, A. (2017, October). "Age Differences in Patterns of Use, Health Knowledge, Perception of E-

cigarettes and Intention to Quit among Current E-cigarette Users". Paper presented at the NIH Tobacco Regulatory Science Conference, Bethesda, Maryland.

2018 Hart, J. L., Walker, K. L., Sears, C. G., Tompkins, L. K., **Mattingly, D. T.**, Groom, A., Landry, R., Giachello, A. L., Payne, T. J., Lee, A. S., Kesh, A., Siu, A., Smith, C., & Robertson, R. M. (2018, February). The "state" of tobacco: Perceptions of tobacco among Appalachian youth in Kentucky. Paper presented at the annual meeting of the Society for Research on Nicotine & Tobacco, Baltimore, Maryland.

2018 Ma, J. Z., Hart, J. L., Walker, K. L., Giachello, A. L., Groom, A., Landry, R. L., Tompkins, L. K., Vu, T-H., **Mattingly, D. T**., Sears, C. G., Kesh, A., Robertson, R. M., & Payne, T. J. (2018, February). "Characterization of Current Adult ENDS Users by Cigarette Smoking Status". Paper presented at the annual meeting of the Society for Research on Nicotine & Tobacco, Baltimore, Maryland.

2018 Tompkins, L. K., Sears, C. G., Walker, K. L., **Mattingly, D. T.**, & Hart, J. L. (2018, March). "Knowledge of Tobacco-Related Cardiovascular Disease Risks: A Study of Appalachian Youth". Paper presented at the 2018 American Academy of Health Behavior, Portland, Oregon.

2018 **Mattingly, D. T.**, Chea T., Cockrell, R., Farley G., Christian C., & Neal, R. E. (2018, March). "Prevalence and Correlates of Tobacco and ENDS Product Use among Young Adult, University Students of Louisville, Kentucky: the 2017 SPOTS Survey". Paper presented at the Graduate Student Regional Research Conference, Louisville, Kentucky.

2018 **Mattingly, D. T.,** Tompkins, L. K., Sears, C. G., Walker, K. L., & Hart, J. L. (2018, March). "Youth Tobacco Users Perceive Less E-cig Harm". *Circulation*, 137, AP087. Paper presented at the EPI Lifestyle Scientific Sessions, New Orleans, Louisiana.

2018 Vu, T-H. T., Hart, J. L., Walker, K. L., Landry, R., Groom, A., Sears, C. G., Tompkins, L. K., **Mattingly, D.T.**, Kesh, A., Giachello, A. L., & Payne, T. J. (2018). Age Differences in Patterns of Use, Health Knowledge, Perceptions, and Intention to Quit Among Current E-cigarette Users. *Circulation, 137*, AP103. Paper presented at the EPI Lifestyle Scientific Sessions, New Orleans, Louisiana.

2018 **Mattingly, D. T.,** Tompkins, L. K., Rai, J., Sears, C. G., Walker, K. L., & Hart, J. L. (2018, June). "Tobacco Use and Communication Channel Preferences Among Appalachian Youth". Paper presented at the Society for Pediatric and Perinatal Epidemiologic Research Annual Conference, Baltimore, Maryland.

2018 **Mattingly, D. T.,** Tompkins, L. K., Rai, J., Sears, C. G., Walker, K. L., & Hart, J. L. (2018, June). "Tobacco Use and Communication Channel Preferences Among Appalachian Youth". Paper presented at the Society for Epidemiologic Research Annual Conference, Baltimore, Marlyand.

2018 **Mattingly, D. T.,** Tompkins, L. K., Rai, J., Sears, C. G., Walker, K. L., & Hart, J. L. (2018, June). "Tobacco Use and Communication Channel Preferences Among Appalachian Youth". Paper presented at the 2018 NIH Tobacco Regulatory Science Meeting, Baltimore, Marlyand.

2018 Hart, J. L., Walker, K. L., Tompkins, L. K., Zachary, A., Wood, L., **Mattingly, D. T.**, Pfeiffer, J. (2018, September). "Environmental Health: Engaging a Community in Research, Partnership, and Practice". Paper to be presented at the Kentucky Communication Association Conference, Prestonsburg, Kentucky.

CONFERENCE PARTICIPATION

2017 AHA Tobacco Regulation and Addiction Center (A-TRAC) Annual Meeting, Louisville, Kentucky (2017, March).
2017 American College of Epidemiology Annual Meeting, New Orleans, Louisiana (2017, September).
2017 IdeaFestival, Louisville, Kentucky (2017, September).
2017 The Root Cause Coalition's Second Annual Summit on the Social Determinants of Health, Louisville, Kentucky (volunteer & attendee) (2017, October).
2017 National Institutes of Health (NIH) Tobacco Regulatory Science Conference, Bethesda, Maryland (2017, October).
2018 Graduate Student Regional Research Conference (GSRRC), Louisville, Kentucky (2018, March).
2018 EPI Lifestyle 2018 Scientific Session, New Orleans, Louisiana (2018, March).
2018 Society for Pediatric and Perinatal Epidemiologic Research Annual Conference, Baltimore, Maryland (2018, June).
2018 Society for Epidemiologic Research Annual Conference, Baltimore, Maryland (2018, June).

MEDIA APPEARANCES

2018 Heflin, J., (2018, June). "Public Health Student Discusses Unique Research Program, Epidemiology Interests". *UofL News*. Article. Louisville, Kentucky.
2018 Heflin, J., (2018, June). "Public Health Student Discusses Unique Research Program, Epidemiology Interests". *University of Louisville*

School of Public Health & Information Sciences Website. Article. Louisville, Kentucky.

2018 Hebert M., (2018, July). "Cancer Education Program; Grawemeyer Winner; Sayed Akhlaq—Scholar at Risk". *UofL Today with Mark Hebert*. Radio Talk. Louisville, Kentucky.

HONORS

2015 Public Health John Snow Scholarship, University of Louisville, Louisville, KY

2015 Public Health Merit Scholarship, University of Louisville, Louisville, KY

2016 Outstanding Capstone Project Award, University of Louisville, Louisville, KY

2016 Undergraduate Summa Cum Laude Award, University of Louisville, Louisville, KY

2016 Department of Epidemiology & Population Health Scholarship, University of Louisville, Louisville, KY

2016 NCI R25 Cancer Education Program Grant, University of Louisville, Louisville, KY

2016 NCI R25 Cancer Education Program 1st Place Award for best research and presentation, University of Louisville, Louisville, KY

2017 IdeaFestival Fellowship, University of Louisville, Louisville, KY

2018 University of Louisville School of Public Health & Information Sciences Travel Scholarship Recipient, University of Louisville, Louisville, KY

PROFESSIONAL MEMBERSHIP

2017- Member, American Heart Association Tobacco Regulation and Addiction Center (A-TRAC)

2018- Member, Society for Epidemiologic Research (SER)

2018- Member, Society for Pediatric and Perinatal Epidemiologic Research (SPER)

CERTIFICATIONS

Teaching English as a Foreign Language (TEFL) Certification (150 Hours)
University of Toronto, Toronto, Canada

FICTION PUBLICATIONS

Fiction in Periodicals

2018 **Mattingly, D.T.**, (2018, May). “Perfect Match”. *The Fiction Pool*: online.
2018 **Mattingly, D.T.**, (2018, May). “Ana and the Window”. *Scrutiny Journal*: online.
2018 **Mattingly, D.T.**, (2018, June). “Neither of Us Are Boyfriends”. *Literally Stories*: online.
2018 **Mattingly, D.T.**, (2018, July). “Behind the Pancakes”. *Scarlet Leaf Review*: print.
2018 **Mattingly, D.T.**, (2018, July). “Move On, Irene”. *Corvus Review*: online.
2018 **Mattingly, D.T.**, (2018, August). “A Final Moment in 1911”. *The Cabinet of Heed Literary Journal:* online
2018 **Mattingly, D.T.**, (2018, August). “Sometimes Heroes Can’t Wear Brown Skin”. *X-R-A-Y Literary Magazine*: online.
2018 **Mattingly, D.T.**, (2018, September). “Your Kind of Thing”. *STORGY Magazine* (Forthcoming): online.
2018 **Mattingly, D.T.**, (2018, September). “Nobody Cares”. *MoonPark Review* (Forthcoming): online.
2019 **Mattingly, D.T.**, (2019, January). “A Little Bit of Everything”. *Red Queen Literary Magazine* (Forthcoming): online.
2019 **Mattingly, D.T.**, (2019, January). “Even the Decent Ones Are Brutal”. *Red Queen Literary Magazine* (Forthcoming): online.
2019 **Mattingly, D.T.**, (2019, April). “Poems for the Devil”. *Riggwelter* (Forthcoming): online.

Drabbles in Periodicals

2018 **Mattingly, D.T.**, (2018, February). “Try Again”. *The Drabble*: online.
2018 **Mattingly, D.T.**, (2018, June). “Knots That Matter”. *101 Words*: online.